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Leveraging CPEC For A Thriving Blue Economy And Coastal Development

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Abstract:

The reclamation of the archaic Silk Road will link China with Africa, the Middle East, and Europe with a railway network, airports, roads, seaports, and an optical fiber network (OBOR). One Belt, One Road is based on two pillars: the maritime Silk Road and the Silk Road economic belt. Six economic corridors form the basis of BRI. The China-Pakistan Economic Corridor (CPEC), is the centerpiece project of China's Belt and Road Initiative, which aims to promote regional connectivity and economic collaboration. This study examines the possibility of using the China-Pakistan Economic Corridor (CPEC) to support Pakistan's coastline development and blue economy. Additionally, it looks at the distinct opportunity that CPEC offers for coastal development and suggests ways to maximize the advantages while minimizing the negative effects on the environment. The research methodology includes a comprehensive review of literature, case studies to gain insights into the challenges and opportunities associated with CPEC and sustainable coastal growth. The study also focuses on the key aspects of the blue economy, emphasizing its potential to promote sustainable development by harnessing the resources and economic activities associated with the sea and coasts. It emphasizes how crucial it is to include sustainability concepts in CPEC projects in order to lessen these risks. Based on the analysis of opportunities and challenges, this study proposes a set of sustainable strategies for leveraging CPEC for blue economy and coastal growth. These strategies encompass ecosystem-based approaches, green infrastructure, renewable energy integration, waste management, climate adaptation measures, and community engagement. This study provides policy recommendations for government agencies, international organizations, and other stakeholders involved in CPEC projects. Based on the assessment of potential and key components, it suggests sustainable strategies for coastal tourism development under the CPEC 1+5 model[1] Proposed in the 2017 Long term plan as well as Maritime SEZ. These strategies encompass the preservation of natural and cultural heritage, community engagement, responsible tourism practices, eco-friendly infrastructure, destination branding, and collaboration with local stakeholders. The findings of this research contribute to the ongoing discourse on sustainable development and provide actionable insights for policymakers and practitioners working in the context of CPEC and coastal regions.

Keywords:

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China-Pakistan Economic Corridor (CPEC), Belt & Road Initiative (BRI), Global Development Initiative (GDI), Blue Economy, Sustainable Development, Coastal Growth, Sustainability, Environmental Impact.

1. Introduction:

Being covered by oceans around 71% of, Planet Earth is a blue planet. with more than three billion people depending on this natural capital for the sustenance of their lives and livelihoods. Given its twin objectives of securing growth and sustainability, the blue economy (BE) has become a pivotal policy discourse, however, terrorism, cyber threats, financial instability, and natural calamities have combined to create headwinds to sustainable globalization and BE. Resultantly, Governments, businesses, and non-governmental organizations stand to be tested by a number of longer-term globalization-related hitches. In short, riding the wave of global breakthroughs made by leaders like Xi Jinping has impacted regional trade and economies at an unprecedented level, especially through the Belt and Road initiative. Xi Jinping emphasized that the BRI is not a one-sided endeavor but a mutually beneficial initiative. He emphasized the need for equal participation, respect for sovereignty, and respect for the development priorities and cultural diversity of participating countries. The aim is to create an open, inclusive, and balanced regional cooperation framework that benefits all participants. Connectivity was a central theme in Xi's speeches (Butt, H. D., Aijaz, U., Saif, O. B., & Athar, A., 2023). He stressed the importance of developing transportation infrastructure, including railways, roads, ports, and telecommunications networks, to facilitate the smooth flow of goods, services, and people across borders. This enhanced connectivity is seen as a catalyst for economic growth, regional integration, and improved living standards. President Xi underscored the importance of sustainable development in the BRI, emphasizing the need to promote green development, ecological conservation, and clean energy. He stressed the integration of environmental protection, social responsibility, and economic development to achieve long-term and sustainable growth. The Belt and Road Initiative (BRI) comprises several corridors that aim to enhance connectivity and promote economic cooperation between China and countries along the routes. The exact number of corridors can vary depending on how they are categorized or defined (Butt, H. D., Ahmed, Z., & Saif, O. B., 2022). Some of the major corridors associated with the BRI:

1.1 Eurasian Land Bridge: This corridor focuses on improving transportation links between China and Europe through both overland and maritime routes. It includes the New Eurasian Land Bridge, which connects China to Europe via rail networks, as well as the China-Mongolia-Russia Economic Corridor.

1.2 China-Pakistan Economic Corridor (CPEC): CPEC is a flagship project of the BRI and comprises a network of transportation infrastructure, including roads, railways, and ports, connecting China's northwestern region to Pakistan's Gwadar Port in the Arabian Sea.

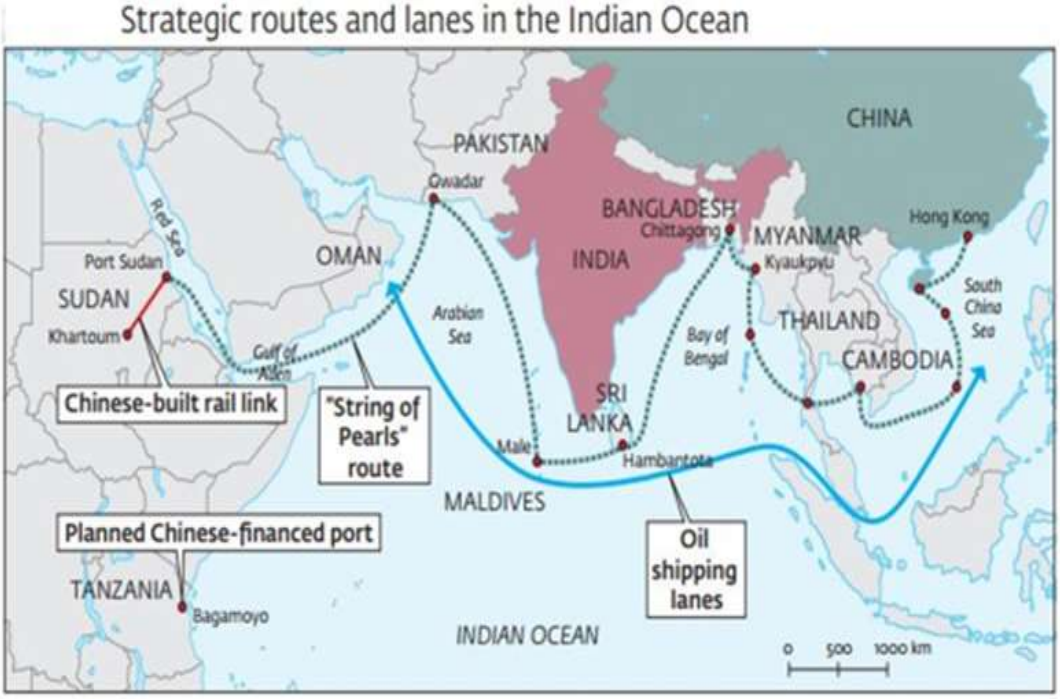
1.3 Bangladesh-China-India-Myanmar Economic Corridor (BCIM): This corridor seeks to enhance connectivity and economic cooperation among Bangladesh, China, India, and Myanmar. It focuses on improving transportation infrastructure and facilitating trade and investment in the region.

1.4 China-Central Asia-West Asia Economic Corridor: This corridor aims to enhance connectivity between China, Central Asian countries, and West Asian countries. It focuses on improving transportation infrastructure, including roads, railways, and pipelines, to promote trade and economic cooperation.

1.5 Maritime Silk Road: The Maritime Silk Road focuses on enhancing maritime connectivity and cooperation between China and countries in Southeast Asia, South Asia, Africa, and Europe. It aims to improve port infrastructure, develop shipping routes, and strengthen maritime trade and investment. China’s vision for the “21st

Century Maritime Silk Road" provides a comprehensive idea to foster deep economic ties, closer cooperation, and expanded development opportunities in the Euro-Asia region. China 's leadership tried to materialize and revive the traditional Silk Road in the form of the "Silk Road Economic Belt" which focuses on infrastructure development through Central Asia and Maritime Silk Road through Southeast and South Asia, for regional and global economic and trade integration.

BRI is based on long-term international cooperation consisting of over 100 countries that depict one-third of the world economy. This massive plan is of infrastructure investment, transport connectivity and shipping networks that will promote international trade and maritime transport. It is a strategic framework that will enhance trade activities and economic zones linking countries in East Asia, Southeast Asia and Africa. It will facilitate trade and the development of logistics (Yu, H, 2017). This will open new avenues for maritime transport, intermodal transport, and seaports. All it requires is the development of infrastructure and the up gradation of the existing facilities. There are various dimensions of the potential impact of connectivity and regional integration. The economic implications are enormous in the form of the proximity of shipping lanes, and the existing ports, hinterland connectivity, and as hubs for cargo transshipment.

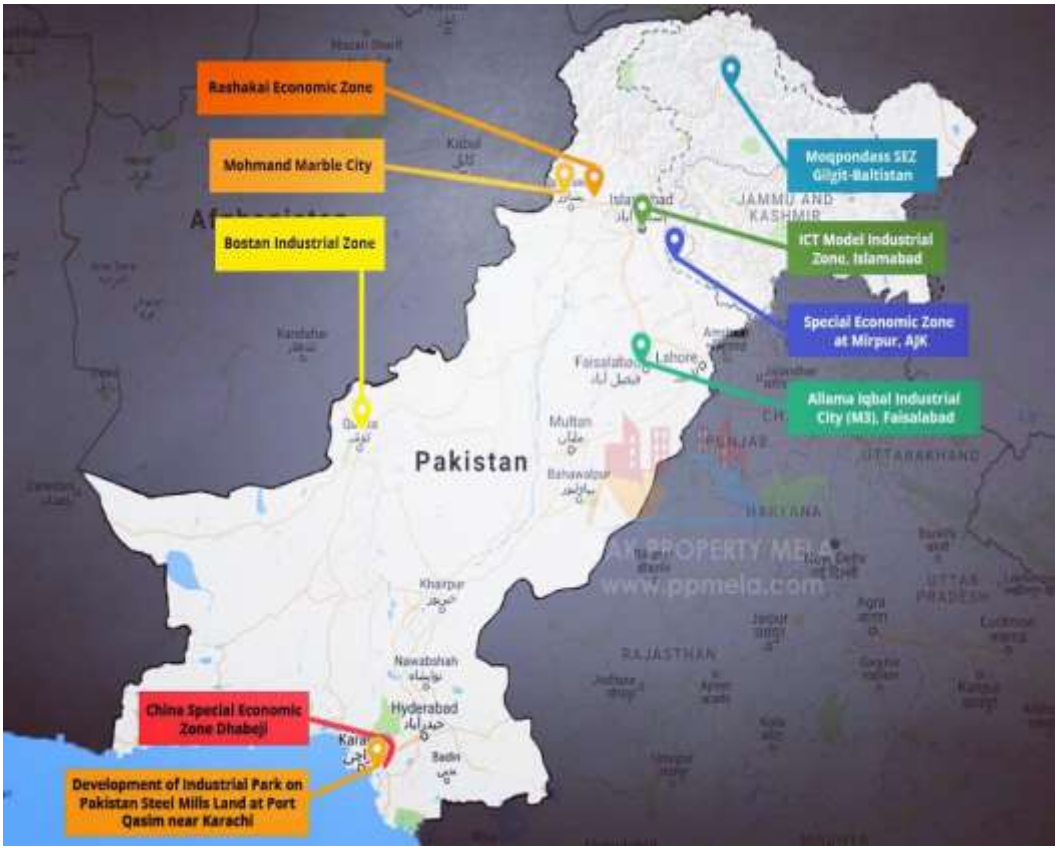


1.6 China-Pakistan Economic Corridor (CPEC):

A significant infrastructure development initiative called the China-Pakistan Economic Corridor (CPEC) aims to improve connectivity and foster economic cooperation between China and Pakistan (Abdul Rab & Rasheed, 2023). Under China's Belt and Road Initiative (BRI), which aims to build a network of commercial and infrastructural ties connecting Asia, Europe, and Africa, it was inaugurated in 2013 and is regarded as a showpiece project (Zhang & Xiao, 2022). A network of infrastructure projects, including roads, trains, pipelines, special economic zones, and energy projects, make up the about 3,000 km-long CPEC (Ismail et al., 2023). In order to promote economic growth and development in the nation, it seeks to enhance Pakistan's transport system, increase energy output, and draw international investment (Rehman et al., 2021). Infrastructure development for transport is one of CPEC's main pillars. For example, the Karakoram Highway, which connects the

Chinese city of Kashgar with the deep-water port of Gwadar, Pakistan, will be built (Naurin & Gul, 2023). Due to its ability to circumvent the Strait of Malacca and offer China a quicker and more direct path to the Arabian Sea, the Gwadar Port in southwest Pakistan is crucial from a geopolitical perspective (Jamali et al., 2023). The development of energy projects is a crucial component of CPEC (N. Shahzad et al., 2023). Through the development of diverse energy sources, CPEC seeks to alleviate Pakistan's chronic energy situation. These consist of installations for renewable energy sources, hydropower schemes, and coal-fired power stations. The CPEC project seeks to reduce power shortages, encourage industrial development, and enhance Pakistani citizens' quality of life in general by enhancing the country's energy infrastructure (N. Shahzad et al., 2023).

The promotion of industrial development is seen to be one of the effective methods for fostering an economy's long-term expansion. To boost their economic growth, numerous countries have adopted industrial development planning during the past few decades like Asian tigers. But in order to achieve this aim, one tactic is to designate places for industrial growth, as we have witnessed numerous nations with business parks, industrial estates, export processing zones, special economic zones, etc. The best example in this regard is China. For instance, by 2009, China has developed almost 1750 SEZs at the province and state levels. As per estimation, SEZs contributed almost 22% in the national GDP of China, 46% in FDI and 60% of total exports accompanied with job creation for 30 million people (Khan, K., Khan, K., & Anwar, S. (2016).



Source: https://www.ppmela.com/wp-content/uploads/2020/07/Special-Economic-Zones-of-Pakistan-1-copy.jpg

Overall, the China-Pakistan Economic Corridor is a sizable project meant to modernize Pakistan's infrastructure and advance its economy (McCartney, 2022a). Despite opposition and difficulties, the project has the potential to be very beneficial for Pakistan and China, enhancing their economic connections and promoting regional cooperation (Khan &

Nawaz, 2021). Various studies identified the fact that, there are several barriers in achieving blue growth through CPEC in Pakistan (Aijaz, U., & Hassan Daud Butt, D. S. P. G, 2021).

1.7 Blue economy:

The land economy is being pushed by economic globalization into the maritime industry. The term "**Blue economy**" also referred to as "**Blue growth**" is frequently used in economics and business studies. Controlling the use, upkeep, development, sustainability, and protection of the state's limited blue resources (sometimes referred to as marine or coastal resources) is the major goal of the blue economy. Blue resources include the oceans, lakes, rivers, and seas. The core elements of the blue economy revolve around the significant blue resources that can boost any state's economic development. These blue resources can also assist in addressing significant economic issues or issues relating to sovereignty, security. Accelerating pace of industrialization along with growth of population exert high pressure on economic planning (Aijaz U., & Butt,2021) so, the sustainable use and management of ocean resources for economic development, bettering human lifestyles, and maintaining the marine environment is referred to as the "Blue Economy" (Vassallo et al., 2023). It includes a number of industries, including biotechnology, tourism, renewable energy, aquaculture, fisheries, and marine transportation. The idea acknowledges the enormous economic potential of the oceans, seas, and coastlines as well as their critical role in sustaining international trade, food security, and ecological balance (Duha & Saputro, 2022). The Blue Economy advocates for conducting economic operations involving seas in a way that ensures the long-term productivity and health of marine ecosystems (Olatidoye, 2022). It places a focus on sustainable business practices, conservation initiatives, and the fair distribution of benefits from the use of ocean resources. The Sustainable Development Goals (SDGs) of the United Nations, especially Goal 14: Life Below Water, which is concerned with the preservation and sustainable use of marine resources, are in line with the ideas of the blue economy (Ridzuan et al., 2022). Second, guaranteeing food security is greatly helped by the blue economy. For a sizeable section of the world's population, fish and seafood products constitute key sources of protein (Ridzuan et al., 2022). The increased demand for seafood may be satisfied with the aid of sustainable fisheries and aquaculture techniques while also protecting the wellbeing and productivity of marine ecosystems (Gebremedhin et al., 2021). This is especially crucial given the world's rising population and the difficulty of feeding an expanding population. Third, the blue economy helps to preserve and protect the environment (Martínez-Vázquez et al., 2021). Maintaining biodiversity, controlling the climate of the planet, and delivering ecosystem services all depend on healthy seas (Oguh et al., 2021). The Blue Economy works to preserve marine biodiversity, reduce climate change, and maintain the adaptability of coastal communities and ecosystems in the face of environmental challenges like pollution, overfishing, and climate change by promoting sustainable practices and protecting marine habitats (Booth et al., 2021).

1.8 Coastal growth:

Coastal growth is the development and economic growth that takes place in coastal regions (Syafiq & Purwoko, 2022). These areas at the juncture of land and water are distinguished by their distinctive ecosystems, cultural history, and economic possibilities. Coastal development includes a variety of industries, including tourism, recreation, trade, agriculture, fisheries, and residential and commercial development (Lubchenco & Haugan, 2023). Due to their natural beauty, closeness to the water, and resource availability, coastal locations are appealing for commercial activity. Because of the beaches, marine life, water sports, and cultural attractions that coastal areas provide, tourism, in particular, contributes significantly to the expansion of the coast (Carvache-Franco et al., 2022). This industry boosts local economies, provides income, and adds employment. Additionally, coastal areas frequently function as significant transportation and commercial centers, supporting trade and commerce on a global scale (Smith et al., 2023). The flow of commodities and the connection of nations and continents are made possible by ports and harbors that are situated along coasts (Ahn et al., 2023). The development of fisheries and aquaculture can

also help coastal areas (Barclay et al., 2021). The sustainable management of fisheries can aid in the economic growth and food security of these areas, since many coastal people rely on fishing as their main source of income (Gamarra et al., 2023). Similar to this, aquaculture—the production of fish and shellfish—has the potential to increase economic possibilities in coastal communities while ensuring a consistent supply of seafood (Stieglitz et al., 2021). However, in order to prevent detrimental environmental and social effects, coastal expansion must be carefully controlled (Qin et al., 2021). Rapid growth without proper planning can cause habitat loss, biodiversity loss, pollution, and coastline erosion (Aguilera & González, 2023). These problems endanger coastal populations' livelihoods and general well-being in addition to harming the ecosystem (Aguilera & González, 2023).

2. Objective/ Purpose of the research:

To examines the possibility for using the China-Pakistan Economic Corridor (CPEC) to support Pakistan's coastline development and Blue economy.

3. Significance of Study:

The research examining the possibilities of using the China-Pakistan Economic Corridor (CPEC) to promote Pakistan's blue economy and shoreline development is significant for several reasons (Ahmad et al., 2023). It starts by addressing Pakistan's urgent need for sustainable coastal development and the protection of marine resources. The report offers helpful insights for maximizing the advantages of this program by looking at how CPEC, as a significant infrastructure project, might contribute to the nation's blue economy (McCartney, 2022b). The study also emphasizes the linkages between sustainable ocean resource use, coastal expansion, and economic development (Su et al., 2021). It emphasizes the necessity of striking a balance between economic development and environmental preservation and acknowledges the significance of combining commercial activity in coastal regions with conservation initiatives. The study presents a tactical method for maximizing the advantages of coastal development while preserving the marine ecology by concentrating on the blue economy potential within the framework of CPEC (Shafqat, 2022). The study also has applications for making decisions and formulating policies. It offers evidence-based suggestions and insights to policymakers on how to use CPEC to advance marine-based sectors, sustain coastal growth, and boost coastal communities' resilience. This knowledge may assist in the creation of thorough plans and legal frameworks that promote economic expansion while protecting the long-term viability of Pakistan's coastal regions. Furthermore, the study is applicable outside of Pakistan. It advances knowledge of how massive infrastructure initiatives like the Belt and Road Initiative and CPEC may be coordinated with sustainable development objectives and blue economy tenets (Wolf, 2021). The study's findings may be used to guide similar programs in other nations, strengthening regional and international collaboration in the process while advancing the blue economy and sustainable coastal development (Nagy & Nene, 2021).

4. Limitations of the Study:

The blue economy involves various sectors such as fisheries, aquaculture, maritime transport, tourism, and renewable energy. Understanding the complex interactions between CPEC projects and these different sectors, as well as their socio-economic and environmental implications, has been challenging and requires interdisciplinary research approaches. Similarly, Ensuring the quality and reliability of available data sources related to CPEC and blue economy development is crucial. Researchers may need to critically evaluate the data sources, methodologies used, and potential biases to ensure the accuracy and validity of their findings. Importantly, CPEC is a significant project with geopolitical implications, and research on its impact may involve political sensitivities. Researchers may encounter challenges in accessing certain information or facing limitations on the scope and direction of their research. Despite these limitations, conducting further research on CPEC and blue economy development can still yield valuable insights by employing

robust methodologies, utilizing available data sources, engaging in collaborative research efforts, and considering a multidisciplinary approach to understand the potential benefits and challenges associated with the project.

5. Sustainable Blue Economy of Pakistan and China:

The ocean connects us, with over 80 % of the volume of world trade carried by sea, and it enables many economic activities that support livelihoods and allow societies to prosper (UNCTAD, 2020a). Recently, oceans have become the focus of substantial global attention and diverse appeals for transformation (Blythe, J. L., Armitage, D., Bennett, N. J., Silver, J. J., & Song, A. M, 2021). The Blue Economy is a concept that emphasizes the sustainable use of ocean resources for economic growth and environmental sustainability. While it is not specific to China, China has been making efforts to incorporate elements of the Blue Economy into its economic development plans, particularly in coastal regions. China has a vast coastline and a significant stake in marine industries such as fisheries, aquaculture, and maritime transportation (Abbasi, J., & Memon, J.A, 2021). The Blue economy is envisioned as a governance system that connects economic development and environmental sustainability at the largest level (Brent, Z.W., Barbesgaard, M. and Pedersen, C, 2020). In 2020–21, the COVID-19 pandemic's massive disruption had an extraordinary impact on the world economy. Uncertainty spread along with several uncoordinated health, sanitary, and economic responses. The pandemic has also brought to light how poorly the world is equipped to respond to some global crises. All three factors reveal the current fragility of international cooperation. Oceanic resources and ecosystems represent more than 70 % of the biosphere and will be a key factor to enable a global sustainable recovery (Alam, K. M., & Li, X., Baig, Saranjam, 2019).

Along a coastline of 1046 kilometers, the western coast of Pakistan spans 750 kilometers. It has a sandy coastline, mountains, headlands, and protected sanctuaries; it is desiccated. The seaward coastal zone is 12 NM and falls under provincial jurisdiction. In contrast, the area beyond 12 to 200 nautical miles falls under federal jurisdiction. The eastern coast of Pakistan is a habitat for numerous species, including tortoises, migratory birds, and fisheries, due to its abundance of flora and fauna diversity. Consequently, this stretch of littoral is endowed with a diverse natural capital that has yet to be exploited.

Pakistan's coastal development has resulted in the establishment of significant ports such as Karachi Port and Gwadar Port, which facilitates international trade and maritime connectivity. This has led to the development of infrastructure and industrialization in littoral regions, enticing investments and fostering economic expansion (Shahzad, 2023). Gwadar, is a natural warm water deep seaport, which has the capacity to accommodate 88 berths as well as to anchor a mother ship of 1, 00,000 to 2, 00,000 DWT. Gwadar is the potential economic hub as it serves as the integral part of the supply chain. Gwadar’s ideal location is the transit route to the Central Asian Regions and China. It is worth mentioning that without Gwadar there is no CPEC

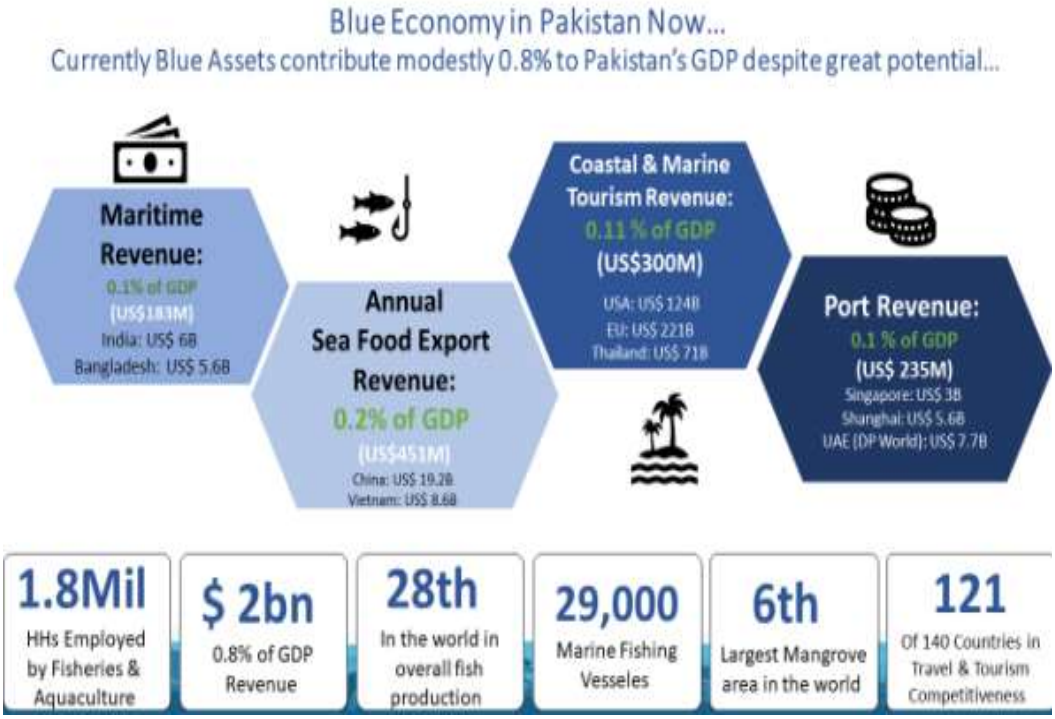
(https://www.pakistangulfeconomist.com/2022/12/26/magnetic-port-of-gwadar-and-cpec/). However, coastal development also presents environmental challenges, such as habitat devastation and pollution that necessitate sustainable practices and cautious management. Through the establishment of Marine Protected Areas and climate change resilience, a balance between economic development and sustainability is sought. Figure below provides a quick glimpse of associate components of coastal development in Pakistan with the help of related statistics (Aijaz, U., & Hassan Daud Butt, D. S. P. G., 2021). The actual potential and utilization of blue economy of Pakistan is:

Potential verses Actual Utilization

Activity	Potential	Actual Utilization
Coastal Tourism	$4.5 billion	$0.05 million
Fisheries	$3 billion	$400-450 million
Seafood Exports	$2 billion	$450 million
Oil and Gas	$14 billion	Nil
Minerals	$4-5 billion	Nil
Shipbreaking	$3 billion	$100 million
Shipbuilding	Data not available	?
Maintenance/Repairs	Data not available	?
Jobs	5 million	1.8 million
Renewable Energy	No survey done	Nil
Coastal Development	No survey done	Nil
Offshore Development	No survey done	Nil

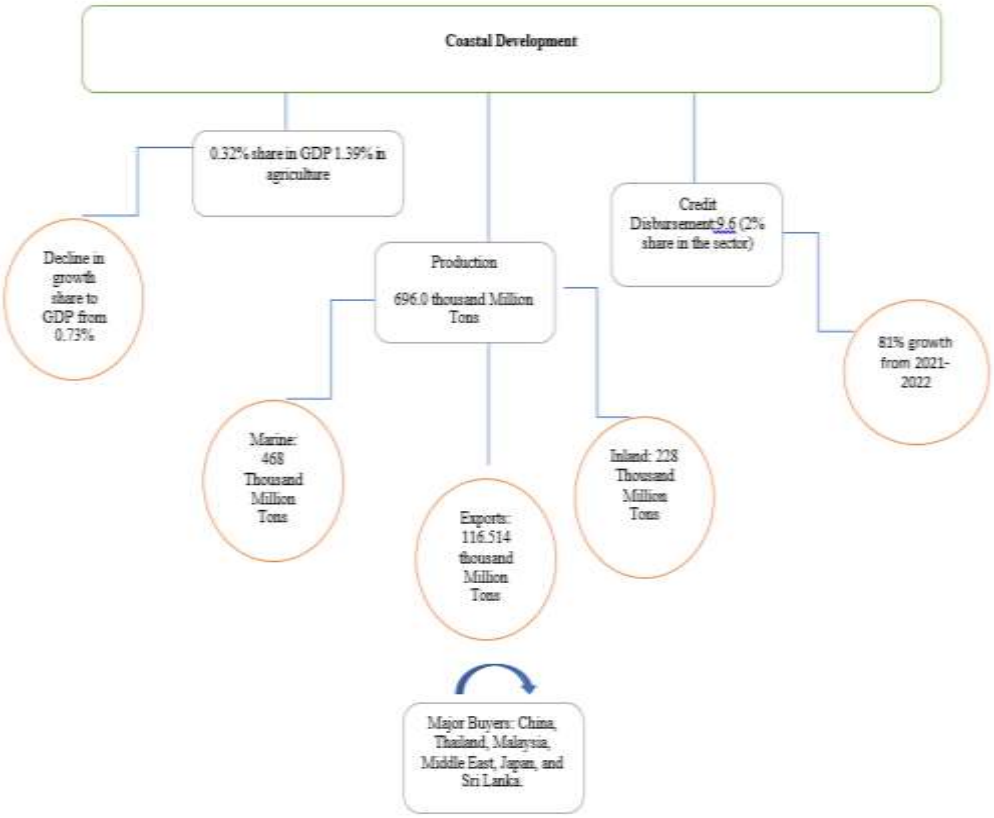
Source: https://strategicthought.ndu.edu.pk/site/article/download/74/64/74

Currently, the blue economy of Pakistan contributes an estimated US$ 1 billion or around 0.4% of the national GDP. Bulk of this contribution is in the form of fisheries, coastal tourism, and maritime revenue (2020).



Source: BoP, 2020

Pakistan is generating almost USD 1526.94 million (242.78 billion PKR) from the sea in 2020, which is less than the half figure of its neighboring countries (Bangladesh and India) and both countries are earning 6-7 billion USD per year.



Source: Ministry of Climate Change and Coordination (2023), https://mocc.gov.pk/PublicationDetail/

An overview of the Coastal Development of Pakistan

Market Analysis:

Regulatory Authority	→	**Provincial and Federal Fisheries Departments**
Initiatives	→	**Inter alia, strengthening of extension services**
Techniques	→	**Value -added Product Methodology**
Societal Link community	→	**Upgradation of of socio-economic conditions of the fishermen**
Policy	→	**Deep-Sea Fishing Policy of 2018**

Source: Pakistan Economic Survey 2022-2023; Marine Fisheries Department ;(Pakistan Bureau of Statistics)

The paradigm of coastal development in Pakistan has been exclusively attributed to the factors of urbanization, population growth, tourism, and industrialization. However, the outcomes of the development have not been well transmuted into the economic growth of Pakistan due to environmental challenges and risks. This section points out towards relevant environmental matters accompanying coastal development in Pakistan. It is a well-evident fact that coastal development in Pakistan is subject to severe erosion that in turn results in coastal degradation (Kanwal, 2022).

Gwadar port development

The Gwadar smart port city master plan project is located in Gwadar with a planning area of 1,193 km2. Gwadar is the gateway linking the Persian Gulf and the Arabian Sea. The city is the southern starting point of the China-Pakistan Economic Corridor (CPEC). In order to promote the cooperation between China and Pakistan, and to ensure that the master plan of Gwadar meets the aim of building a varied, prosperous, dynamic, and green industrial system will be the development aim in terms of economic growth and industrial advancement in order to achieve rapid economic growth and generate a new engine for the regional economy (Khetran, M. S, 2014). In the near future, Gwadar will make full use of its geographic location and fishing advantages while concentrating on its competitive industries. The industrial chain is being expanded and the industrial level raised in the medium to long term. In terms of transport infrastructure, construction projects planned for the China-Pakistan Economic Corridor, such as the new airport and railways, are being developed so as to add more gateways to connect the city with the transportation nodes of Pakistan (Hussain, F. ,2020). An urban transport network featuring 5 horizontal and 15 vertical arteries are being constructed so as to enhance connectivity among the city center, sub-centers and functional clusters. The port development project is important for the social-economic and infrastructure development of Gwadar. As Gwadar is an important sector of CPEC, scientific planning on the basis of the top-level design will help Gwadar to become a benchmark city in CPEC projects. The project will promote the sustainable development of Gwadar (Aijaz, U., & Hassan Daud Butt, D. S. P. G., 2021). The development of the Gwadar port promotes the district economic development and transforms Gwadar into a prosperous city to take full advantage of Gwadar's geographical location as a major gateway to the sea in southwest Pakistan and its port conditions, and leveraging the China-Pakistan Economic Corridor to accelerate the construction of transport infrastructure and develop functions for a comprehensive gateway so as to build Gwadar into a national gateway in southwest Pakistan.

Using the development models, the development scale of the Gwadar port throughput is forecasted according to the development needs of different hinterland areas is being developed to promote industrialization in the region (Gwadar Master Plan ,2017 & Hussain, F. ,2020).

Hinterland	Development Goals	Transportation Needs
Gwadar	The fulcrum of economic development in western Pakistan	Urban Construction：Mineral materials, etc. Industrial Development: Transportation of Raw Materials and Finished Goods Daily Life: Food, etc.
Balochistan Province		Industrial Development: Mineral Resources Outbound Shipping, etc. Daily life: Imports of Daily Necessities
Indus region in Pakistan	The main port of western Pakistan	Transfer of large bulk cargoes such as coal.
Western China	A passageway to the sea of Western China	Import and Export Trade of Consumer Goods
Five Central Asian Countries and Afghanistan	A gateway to the sea of the five countries in Central Asia and Afghanistan	Import and Export Trade of the Landlocked Countries
South Asian Region	A trade center in South Asia and Adjacent to the Middle East	International transshipment

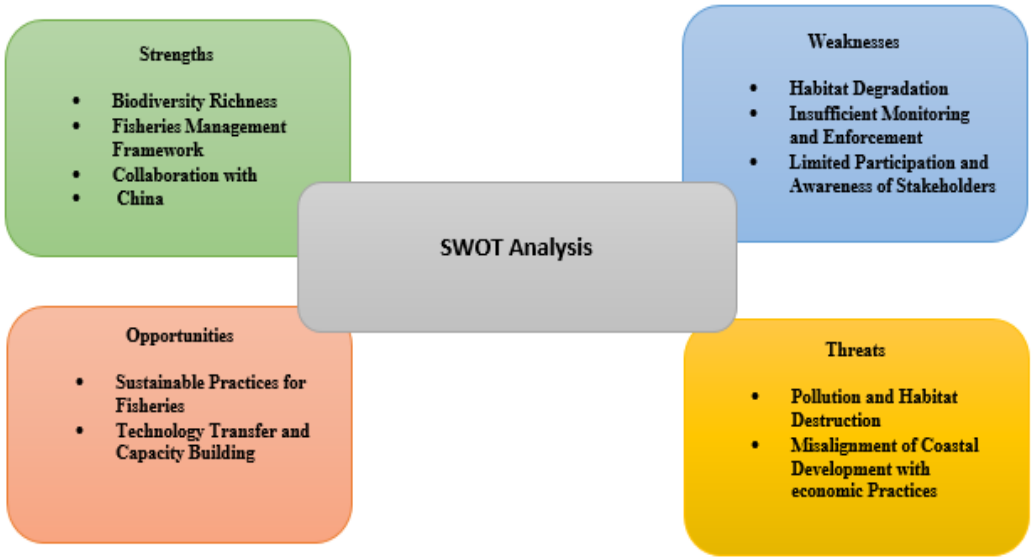
Source: (Gwadar smart port city master plan, 2017)

6. Impacts of Marine Ecosystems and Biodiversity:

In order to assess the coastal development insights, it is conventional to align the impacts of marine ecosystems and biodiversity with the Fisheries Management of Pakistan. Effective fisheries management is essential for ensuring the sustainable use of fisheries resources and sustaining the long-term productivity of marine ecosystems (Mohsin et al., 2022). In Pakistan, fisheries management entails multiple facets, such as establishing capture limits, instituting gear restrictions, monitoring fishing activities, and enforcing regulations. However, obstacles such as limited resources and capacity, a lack of coordination between relevant authorities, and the difficulty of combating illegal, unreported, and unregulated (IUU) fishing (Colombage, 2021).

Referring to the association of fisheries sector with the CPEC, it exhibits both associated strengths and weaknesses. Henceforth, figure 3.2 demonstrates a quick view of SWOT analysis that has been performed to explain the marine ecosystems and biodiversity in the context of CPEC through fisheries management.

SWOT Analysis for Marine Ecosystems and Biodiversity



The Swot analysis in the figure above has been performed keeping in view rich diversity of Pakistan's marine ecosystems (coral reefs, mangroves, and coastal wetlands). The current framework for managing fisheries contributes indirectly to the preservation of marine ecosystems and biodiversity through its support of the conservation and sustainable use of marine resources. In collaboration with China, the CPEC initiative provides opportunities for knowledge sharing, capacity development, and access to best practices in marine ecosystem conservation and fisheries management (Nabi et al., 2018). Nonetheless, the development activities associated with CPEC can result in habitat degradation, inadequate monitoring and enforcement, and limited public awareness and stakeholder participation (Lashari et al., 2021).

6.1 Marine Protected Areas and Biodiversity Conservation:

There is an extensive debate in the literature regarding the Marine Protected Areas around the globe. Marine Protected Areas (MPAs) and biodiversity conservation are vital elements of global efforts to protect and manage marine ecosystems in a sustainable manner. Predominantly, these protected areas protect marine biodiversity, habitats, and species, serving as refuges for endangered species, allowing population recovery, and contributing to the overall health and resiliency (Ullah et al., 2021). Biodiversity conservation is essential for sustaining the planet's equilibrium and functioning, as it enables ecosystem services such as nutrient cycling, carbon sequestration, and shoreline protection. Preserving biodiversity assures the sustainability of fisheries, scientific research, and the livelihoods of coastal communities (Nabi et al., 2018). Globally, nations work to protect and conserve marine biodiversity by designating protected areas, implementing regulations, monitoring compliance, and encouraging stakeholder participation. MPAs contribute to the sustainable use of resources and the long-term health of the ocean by protecting marine ecosystems and biodiversity (Munir & Khhayyam, 2020).

Marine Protected Areas in Pakistan

Table presents the details of the MPAs that stands out in terms of their location, status, area and relevance for Pakistan.

Details of MPAs in Pakistan

MPA	Location	Status	Covered Area	Conservative Relevance
Astola Island	Balochistan, Arabian Sea	Largest offshore island	6.7 km2 (2.6 sq mi).	• Rich terrestrial and marine biodiversity (Nesting sites for seabirds, marine turtles) • Presence of important coral reef ecosystems
Churna Island	Sindh (Off coast)		0.60000 km2 (0.23166 sq mi)	• Safeguards the island's coral reefs, sea grass beds, and associated marine species • Promoting sustainable tourism and recreational activities.
Sonmiani Bay	Karachi (Near Coastline)		125.25 km2	• Diverse marine ecosystem • Supports fisheries resources and local livelihoods
Jiwani Coastal	Balochistan		46.00 km2	• Diverse habitats • Conserve the region's marine biodiversity, including endangered species such as green turtles and hawksbill turtles

Best Marine Protected Areas Practices in Pakistan

For MPAs and biodiversity conservation efforts in Pakistan to be effective, table 3.1 provides an overview of the best practices for Pakistan considering four major policy areas.

Dimension-wise Best Practices for Marine Protected Areas and Biodiversity Conservation

Dimension	Best Practices
Stakeholder Assignation	• Follow a bottom to top approach by Involving local communities, fishing communities, and relevant stakeholders in MPA planning • Foster decision-making processes to create a sense of ownership,

	promotes compliance, and improves conservation outcomes.
Appropriate Execution and Monitoring	• Robust enforcement mechanisms while highlighting the significance of blue economy • Installation of monitoring setups for aquaculture • Assuring compliance through preventing IUU fishing • Alignment of MPA regulations to sut down possibilities of threaten biodiversity and ecosystem health.
Collective Efforts	• Collaboration between government agencies, non-governmental organizations, scientific institutions, and international partners • Knowledge sharing • Technical expertise • Financial resources to support the establishment, administration, and monitoring of MPAs
Adaptive Management	• Adaptive management strategy for ongoing learning. • Regular assessments and scientific monitoring aid in evaluating the efficacy of MPAs • Adjustment of management strategies while ensuring the long-term success of conservation efforts

6.2 MPAs and CPEC:

The development of CPEC and related activities can impact marine ecosystems and biodiversity. Incorporating Marine Protected Areas (MPAs) into CPEC design and implementation can provide a proactive conservation strategy. By effectively designating and managing MPAs, advantages can be realized, such as protecting key biodiversity areas like Astola Island, promoting sustainable fisheries management, and enhancing climate change resilience (Farooq, 2020). MPAs can protect reproductive grounds, allowing fish populations to flourish, and provide carbon capture, littoral protection, and biodiversity support. For example, the Churna Island MPA in Pakistan protects coral reefs and fish species, promoting sustainable tourism and recreational fishing. Overall, MPAs can help mitigate the effects of climate change and protect vital habitats like mangroves and sea grass meadows in Pakistan's coastal regions (LAsahri et al., 2021).

6.3 Sustainable Fisheries Management:

As mentioned earlier that Fisheries has developed a a well-designed fisheries management framework for the growth and development of the sector. Therefore, it is high time for Pakistan to implement conservative strategies and best practices in sustainable fisheries

management on ad-hoc basis (Ullah et al., 2023). By doing so, it is presumed that the economy would be able to ensure long-term viability of its fishery resources and support the socio-economic well-being of coastal communities. Table 3.2 define a few best practices that can be taken into account in development plans for implementing sustainability of fisheries sector given the wider benefits of the CPEC.

Dimension-wise Best Practices for Sustainable Fisheries Management

Dimension	Best Practices
Conservation and Resource Management	• Implementation of regulations through enforcement to control fishing efforts, fishing gear, and catch limits • Strict prevention of overfishing in breeding seasons
Monitoring Through Data Collection	• Ensure updates data for Fisheries • Special focus on information for coral reefs, mangroves, and sea grass beds to support fisheries sources • Execution of regular primary surveys to capture the dynamics of the sector and sustainability performance • Investments for monitoring of Fish stocks and management set ups
Ecosystem-Oriented Management of Fisheries	• Establishments of MPAs to protect natural habitat • Prohibition of blast fishing, cyanide fishing, and bottom trawling to avoid destruction of habitat • Support to initiative such as the Community-Based Fisheries Management in Pakistan's Sindh province • Participation of local communities in resource management
Education, Training, and Capacity Building	• Promotion of co-management approaches or bottom to down approaches • Involvement of fishing communities and villagers' non-governmental organizations

The best practices in the table above indicate that implementing fisheries regulations, accumulating accurate data, and promoting ecosystem-based fisheries management are all components of resource management and conservation (Awais et al., 2019). Establishing protected areas and regulating detrimental activities ensures the long-term health and productivity of fisheries habitats by ensuring their long-term health and productivity. Prohibiting detrimental fishing methods, such as blast fishing, cyanide fishing, and bottom trawling, reduces the negative effects on marine ecosystems (Baset, 2020). Local

communities, non-governmental organizations (NGOs), and stakeholders must be involved in decision-making processes for sustainable fisheries management to be achieved. Fishermen and managers can gain a better comprehension of sustainable fishing practices, resource conservation, and ecosystem health through training and education programs (Nazir et al., 2015). Integrating conservative strategies into CPEC's development plans can promote the sustainable use of fisheries resources, the preservation of biodiversity, and the well-being of coastal communities.

6.4 Coastal Zone Management and Resilience Climate Change:

The discussion on conservative strategies cannot be completed without highlighting the role of coastal zone management (CZM) and resilience change management (RCM). These management insights are well-equipped to deal with the existing issues of Pakistan in terms of Coastal development and conservative strategies. Table sheds lights on different best practices that can be implemented to diversify the dimensions of CZM and RCM.

Dimension-wise Best Practices for Coastal Zone Management and Resilience Climate Change

Dimension	Best Practices
Integrated CZM	• Consideration of the entire coastal zone • Capturing ecological, social, and economic aspects • Sustainable use of land through avoiding constructions in vulnerable areas • Conservation for coastal ecosystems • Reduction in erosion by supporting provision of essential habitat for marine species • Engagement of stakeholders
Adaptive Measures for RCM	• Implementation of adaptive strategies • Adaption for sea-level rise, increased storm intensity, and coastal erosion • Construction of coastal defenses through natural buffers • Installation of early warning systems
Smart Climate Structure	• Construction of ports and coastal development • Survey-based research to capture short term variations • Execution of scientific research and monitoring programs

The above table summarizes that targeting ICZM principles into coastal infrastructure initiatives within the context of CPEC can reduce environmental impacts and improve the resilience of coastal ecosystems (Salik et al., 2015). Examples include the Sundarbans mangrove forest, which is shared by Pakistan and Bangladesh and protects coastal areas from cyclones and tidal surges while providing habitat for wildlife species. Strategies for

climate change resilience consist of adaptation measures, climate-smart infrastructure, and research and monitoring. Considering climate change resilience in CPEC projects can aid in risk mitigation and ensure the long-term viability of coastal infrastructure. For example, the Karachi Coastal Comprehensive Development Zone, a proposed CPEC development project, can incorporate climate-resilient design principles, such as green infrastructure, sustainable drainage systems, and coastal protection measures. By incorporating conservative strategies and best practices in coastal zone management and climate change resilience, Pakistan can effectively balance economic development objectives with the preservation of the coastal environment, biodiversity, and the welfare of coastal communities.

6.5 Pollution Control and Waste Management

To mitigate the adverse environmental effects of industrial development, particularly those related to CPEC, Pakistan is in a dire need to implement conservative strategies and best practices in pollution control and waste management. In this sense, table shared overviews the best practices for Pakistan that can be implemented to acquire benefits from the CPEC.

Dimension-wise Best Practices for Pollution Control and Waste Management

Dimension	Best Practices
Strict Regulatory Framework	• Institutionalization of an include environmental regulation setting • Monitoring of pollutant emissions and environmental quality indicators • Encouraging industries to adopt cleaner production techniques (use or renewable energy resources)
Reduction and Recycling	• Ensuring waste reduction at the source • Effective waste segregation systems to avert excess from landfills • Will to fulfil responsibilities by industries
Disposal Measures	• Provision of proper waste disposal facilities • Promotion of waste to energy plants • Environmentally sound management of waste
Educations for Public	• Awareness campaigns • Encouragement of responsible consumption • Volunteer participation of community in waste management

The strategies in table above include the implementation of stringent regulatory frameworks, pollution monitoring and reporting systems, and the promotion of cleaner production techniques (Mahfooz et al., 2020). Including pollution control measures in infrastructure initiatives, such as the Port Qasim Industrial Zone in Karachi, can reduce pollution and safeguard the environment. Included in waste management practices should be waste reduction and recycling, appropriate disposal and treatment, and public education campaigns. Incorporating sustainable waste management practices into CPEC projects can

aid in mitigating the escalating refuse generation caused by increased economic activity. For instance, the development of Gwadar Port can incorporate waste management infrastructure and practices to manage waste generated by port operations and associated activities, such as refuse collection systems, recycling facilities, and appropriate disposal facilities. Pakistan can mitigate the environmental impacts of industrial development and ensure sustainable growth within the framework of CPEC by adopting conservative strategies and best practices in pollution control and waste management, thereby contributing to a cleaner environment, protecting public health, and supporting the country's transition to a more sustainable and circular economy.

According to study, Pakistan's coastal development creates both chances for economic expansion and environmental difficulties. It can boost trade, fishing, and tourism, but it also puts communities and ecosystems along the coast at danger. Coastal erosion is another of the biggest environmental problems. Natural coastal processes can be hampered by unplanned and uncontrolled development along the coast, including the creation of structures, ports, and infrastructure. It causes infrastructural damage, important coastal land to be lost, and an increase in erosion vulnerability. Coastal erosion threatens coastal communities, their way of life, and vital ecosystems in addition to the natural beauty of the shoreline (S. Shahzad et al., 2023). Pakistan's coastline is particularly susceptible to the effects of climate change, such as sea level rise, stronger storms, and coastal flooding. These vulnerabilities may be made worse by coastal expansion without sufficient planning and climate change adaptation measures. Storm surges and sea level rise can endanger coastal communities, houses, and infrastructure. The loss of important coastal resources and increased damage from extreme weather events may be the results of insufficient coastal protection measures (S. Shahzad et al., 2023).

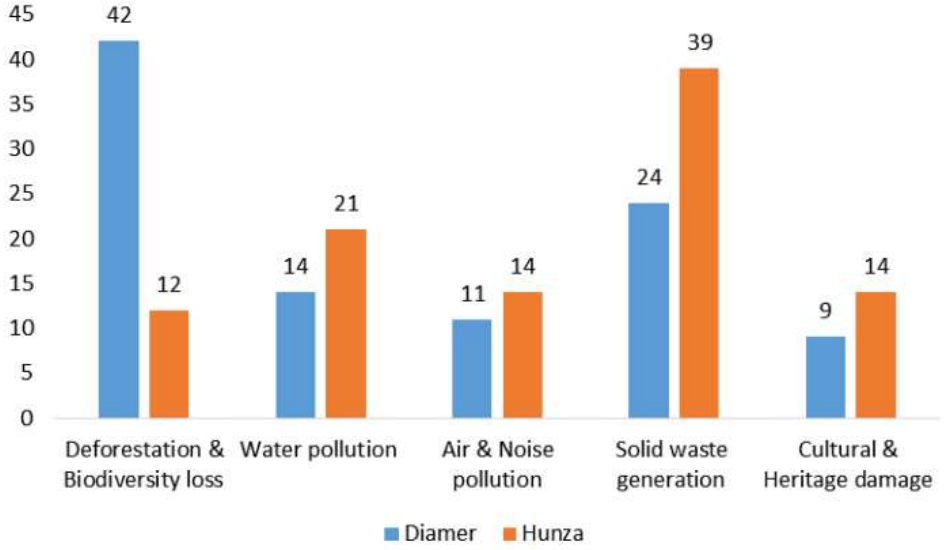


Figure: Comparison between Diamer and Hunza

6.6 Impacts on marine ecosystems and biodiversity:

The blue economy and coastal growth in Pakistan have significant impacts on marine ecosystems and biodiversity. While these sectors contribute to economic growth and development, it is crucial to assess and address their potential negative consequences on the environment. This assessment will explore the impacts of the blue economy and coastal growth on marine ecosystems and biodiversity in Pakistan.

6.7 Socio-economic aspects of Blue economy and coastal growth:

The blue economy refers to the sustainable utilization of ocean resources for job creation, enhanced living standards, and environmental preservation. It includes many industries,

including aquaculture, tourism, maritime transportation, renewable energy, and marine biotechnology. The blue economy and coastal growth have substantial socioeconomic aspects in Pakistan's situation, with a lengthy coastline along the Arabian Sea (Faran & Ejaz, 2022). However, it has been essential to ensure that Pakistan's coastal growth and blue economy development are carried out sustainably and with concern for environmental preservation. To avoid overexploitation and retain the long-term socioeconomic aspects of the blue economy, proper legislation, enforcement of fishing practices, coastal zone management, waste management, and preservation of marine ecosystems are crucial (Asif, 2022). In Pakistan, the socio-economic aspects of the blue economy and coastal development remain dynamic and dependent on a range of elements, including governmental decisions, geopolitical developments, climatic changes, and regional collaboration. Regular monitoring, adaptive management, and stakeholder participation must occur(Cavallo et al., 2023).

Pakistan's blue economy and coastal growth offer significant socio-economic benefits and opportunities. Harnessing the potential of coastal resources and developing various sectors within the blue economy can contribute to sustainable development, poverty reduction, and improved livelihoods. This analysis explores the socio-economic benefits and opportunities associated with Pakistan's blue economy and coastal growth.

6.7.1 Employment generation:

Coastal growth and the emergence of the blue economy have the potential to generate a variety of livelihood opportunities. A diversified workforce will be needed for fisheries, aquaculture, tourism, maritime transport, renewable energy, and marine biotechnology. Pakistan can alleviate the issue of unemployment, particularly in coastal areas, by investing in these sectors. New jobs can benefit coastal communities by increasing income levels, lowering poverty, and enhancing the quality of life (Lohano & Maqbool, 2022).

6.7.2 Economic diversification:

Qayyum and Rehman (2022) Stated that, in Pakistan, increasing the blue economy and coastline development might encourage economic diversification. Agriculture and textiles have always been the main economic drivers in the nation. A possibility to diversify the economy and lessen reliance on conventional sectors exists with the development of the blue economy. Growth in aquaculture, tourism, renewable energy, and fisheries can make an economy more robust and dynamic and less vulnerable to outside shocks.

6.7.3 Revenue generation:

The development of Pakistan's coast and the blue economy has the potential to bring in a sizable amount of money. Increased international trade and tourist spending can boost foreign exchange revenues for the tourism industry, maritime transportation, and port operations. The potential for export of seafood products can be increased through the sustainable management of fisheries and aquaculture resources. The growth of renewable energy projects can also lower energy imports while increasing domestic energy production's financial benefits (Qayyum & Rehman, 2022).

6.7.4 Poverty reduction:

Research shows that the blue economy and coastal growth can be crucial in reducing poverty. Coastal communities, often marginalized and economically disadvantaged, benefit from employment opportunities, increased income, and improved living standards. The blue economy can uplift communities and alleviate poverty by providing sustainable livelihood options, training programs, and access to finance and resources(Faran & Ejaz, 2022).

6.7.5Infrastructure development:

Infrastructure development has been required due to the expansion of the blue economy and coastal regions. The development of the economy as a whole benefits from investments

in ports, marinas, tourist attractions, renewable energy infrastructure, and transportation systems. In addition to stimulating auxiliary sectors and enhancing connectivity within and outside coastal regions, infrastructure projects generate employment during development and operating periods. These changes can spur economic expansion and increase capital (Thakur, 2022).

6.7.6 Tourism and recreation:

As per prior research, coastal tourism and recreation development can significantly impact economic expansion and job creation. Local and foreign tourists are drawn to Pakistan's coastal regions for their beautiful beaches, coral reefs, and unique marine ecosystems. Many jobs in the hospitality, transportation, tour guide, and souvenir industries can be created by investing in tourism infrastructure, which includes hotels, resorts, restaurants, and recreational facilities. Furthermore, the money from tourism-related activities can boost regional economies, helping small businesses and raising people's living standards (Asif, 2022). It is important to note that Tourism generates around 5% of national GDP whereas coastal tourism in Pakistan is a lot to discover. Recently, a desert beach "Kund Malir" was discovered and immediately it caught attention of the world for its captivating beauty. The coastal tourism forced the foreign tourists to come and explore Pakistan. There are more than 10 beach spots in Pakistan right now that have been discovered. The tourists around the world are being attracted towards beautiful places especially the sea coasts with vast biodiversity and attractive beaches. Pakistan's beaches are full of beautiful land features. If the spots are developed well by the government, it can provide the revenue of more than $4 billion to the national economy. Pakistan has beautiful beaches along its coastline. There are terms and policies that make a framework set by Government and Private Organizations for the operations in blue economy.

7. Importance of international cooperation and partnerships:

In order to overcome obstacles and realize the objectives of coastal development and a sustainable blue economy, international collaboration and partnerships are of the utmost importance. Coastal areas frequently cross international borders, and human activities like pollution, overfishing, and climate change can have global effects. In managing shared resources, addressing trans-boundary concerns, and assuring the sustainable use of coastal and ocean resources, international collaboration enables shared accountability and cooperative efforts (Caglar et al., 2022). Similarly, International collaboration makes it easier for countries to share knowledge, best practices, and scientific research. Sharing of experiences, lessons gained, and creative approaches to coastal management are all made possible by this, allowing for well-informed decision-making and efficient policy creation (Echendu, 2022). In order to strengthen their institutional frameworks, policies, and regulatory systems for sustainable coastal development, developing nations may need technical assistance and capacity training. Through international collaboration, governments can implement sustainable practices and strengthen their institutional capacity by transferring knowledge, resources, and capital to assist capacity building efforts (Xue et al., 2022).

According to study, collaborative research and monitoring programs at the international level help generate comprehensive and reliable data on coastal ecosystems, climate change impacts, and resource management. Such cooperation enables the development of standardized methodologies, data sharing platforms, and joint research initiatives that contribute to a deeper understanding of coastal processes and effective decision-making (Dall-Orsoletta et al., 2022). In addition, partnerships and international cooperation are essential for sustainable blue economy governance and coastal development.

8. Evaluation of Blue Economy in China:

China in its development model has been emphasizing the Sustainable Development Goals, in particular, Goal 14 (life below water). Oceans are home to 80 of the world's biota and

their ecosystems have a higher diversity of living organisms than terrestrial ecosystems (Suleria, 2015). The role of trade of ocean-based goods and services, Blue finance and marine innovation can only be underlined in responding to these challenges recognizing the potential of the ocean economy, China has been promoting the development of marine industries as part of its overall economic strategy. China is committed to achieving the policy goals outlined in the 2030 agenda for Sustainable Development and other international agreements, such as the Small Island Developing States Accelerated Modalities of Action Pathway, a sustainable and resilient maritime economy is essential (Song et al., 2016).

China's objective of becoming a powerful nation and its efforts to advance its status and strength in the international arena as a project of geopolitical modernization is key themes in its blue economy initiatives (Hassan Daud Butt, Zainab Ahmed, Osman Bin Saif, 2022). The objective of economic modernization and, to a lesser extent, ecological modernization directly supports and is intimately tied to geopolitical modernization (Sze, J., 2015). Chinese soft power through the Maritime Silk Road and greater involvement in multilateral ocean issues and fora, as well as Chinese hard power exhibited in maritime disputes, is thus fundamentally intertwined with the exploitation of and control over access to ocean economic resources in Chinese discourse. They contribute in this way to national development plans aimed at realizing communist modernization and the Chinese leadership dream (Butt, H. D. (2020). China is working on a balance between marine economic growth and protection of the natural services provided by the ocean. This article explores the various strategies China and the US are using to address this conundrum by advancing the idea of the "Blue Economy."

The Blue Economy is typically associated with the following pillars or dimensions:

i. **Sustainable Fisheries and Aquaculture**: This pillar focuses on the sustainable management of fisheries resources and the responsible development of aquaculture. It includes measures to prevent overfishing, promote responsible fishing practices, and ensure the long-term viability of fish stocks. Sustainable aquaculture practices, such as integrated multi-trophic aquaculture and land-based aquaculture, are also emphasized.
ii. **Renewable Energy**: The Blue Economy promotes the development and utilization of renewable energy sources from the ocean, such as offshore wind, tidal energy, and wave energy. By harnessing these resources, it aims to reduce dependence on fossil fuels and mitigate climate change while supporting economic growth.
iii. **Coastal and Marine Tourism**: This pillar focuses on sustainable tourism development in coastal and marine areas. It involves promoting responsible tourism practices, protecting sensitive ecosystems, and creating opportunities for local communities to benefit from tourism while preserving natural and cultural heritage.
iv. **Marine Biotechnology and Pharmaceuticals**: The Blue Economy emphasizes the exploration and sustainable use of marine biodiversity for biotechnological and pharmaceutical applications. It involves research and development in areas such as marine-based medicines, bioactive compounds, and bio-products derived from marine organisms.
v. **Ocean Governance and Policy:** Effective ocean governance and policy frameworks are crucial for the sustainable development of the Blue Economy. This pillar involves establishing regulations, management systems, and international cooperation mechanisms to ensure the responsible use and conservation of marine resources.
vi. **Marine Pollution Prevention and Waste Management**: The Blue Economy aims to address the issue of marine pollution and promote effective waste management practices. It involves measures to prevent pollution from land-based sources, minimizes marine litter, and promote recycling and waste reduction initiatives. China has implemented programs and initiatives to protect and restore marine ecosystems. These include the establishment of marine protected areas (MPAs), the conservation of key habitats, and

the restoration of degraded coastal areas. China has also launched initiatives to restore coral reefs and enhance the health of coastal wetlands. In recent years, China has undertaken various initiatives to promote the Blue Economy. This includes investment in offshore wind power projects, the development of marine biotechnology and pharmaceutical industries, and the expansion of sustainable fisheries and aquaculture practices. China has also focused on improving marine environmental protection and reducing pollution in its coastal areas.

Moreover, China's Belt and Road Initiative (BRI) includes plans for the development of maritime infrastructure, such as ports and shipping routes, which align with the principles of the Blue Economy by facilitating sustainable trade and connectivity. It is important to note that the specific implementation and extent of the Blue Economy concept in China can vary across different regions and sectors. Additionally, economic policies and strategies can evolve over time, so it's advisable to refer to the most up-to-date sources and research for detailed information on China's approach to the Blue Economy (Chen, J. L., Kevin X, Liu, Xiang, 2017). The development of ship registration policy in China: Response to flags of convenience. Ocean governance and policy in China have become increasingly important as the country seeks to balance economic development with environmental sustainability in its coastal and marine areas. Nearly all of China's 9,000 miles of coastline extend from the Vietnamese border in the south to the North Korean border in the north. It also encompasses a number of island possessions' coastlines. The 11th Five-Year Plan, Beijing's strategic economic growth plan, which encompassed the years 2006 through 2010, included a set of particular data that covered the maritime sector, and it is this plan that first sparked the Chinese government's interest in the Blue sector (Dellios, R., & Ferguson, R. J. (2017). As a result, China's top executive body, the State Council, released a new set of detailed goals in the 12th Five-Year Plan, which runs from 2011 to 2015. Since then China, is achieving a Blue Recovery and the transformation of its Blue economy through the most significant investment drive ever. This will change as the ocean economy as a concept becomes more and more visible to investors, banks, and other economic actors worldwide. Certain guiding principles for sustainable investment in addition to creating a typology of blue economy sectors and segments.

According to the State Oceanic Administration, the structure of China's blue economy spans almost all of the country's industries. China's marine economic development strategy includes tourism as well as new and emerging industries like marine bio prospecting, which is a relatively recent development. It is a supplement to traditional marine resource uses like fishing, shipping, and oil and gas extraction. According to this wide definition, China's Blue Economy appears to be prepared for large growth and is expected to contribute significantly to the nation's economic growth in the upcoming year. The key aspects of ocean governance and policy in China include:

9. **Legal Framework:** Ocean governance refers to the structures, processes, rules, and norms that determine how people make decisions, share power, exercise responsibility, and ensure accountability in the use and management of marine resources (Kooiman, 2003; Cundill and Fabricius, 2010). However, research has also shown that ocean governance transformations can serve as a catalyst for grassroots resistance to privatization and social movements in defense of marine access rights and different ways of relating with/to ocean spaces and species (Pinkerton, 2017; Boucquey, 2017; Todd, 2018). China has established a legal framework to govern its oceans, primarily through the Law of the People's Republic of China on the Administration of Sea Areas (adopted in 1984 and revised in 1992 and 1998) and the Law of the People's Republic of China on the Exclusive Economic Zone and the Continental Shelf (adopted in 1998). These laws define China's maritime zones, rights, and responsibilities, and provide a basis for marine resource management and environmental protection.

9.1 Marine Spatial Planning: China has been working on the development of marine spatial planning to allocate and manage various ocean uses effectively. The Marine Functional Zoning Plan and Marine Ecological Red Line are examples of planning initiatives that aim to balance economic development, conservation, and sustainable use of marine resources. China has implemented ICZM programs to enhance the coordinated management of coastal areas. These programs involve multiple government departments and agencies to address issues such as land-use planning, pollution control, ecosystem conservation, and sustainable development along the coast.

9.2 **Marine Protected Areas (MPAs):** China has been expanding its network of MPAs to conserve marine ecosystems and protect biodiversity. These protected areas aim to safeguard critical habitats, species, and ecosystems while allowing for sustainable use and development within designated zones.

9.3 Fisheries Management: China has implemented various measures to regulate its fisheries and combat illegal, unreported, and unregulated (IUU) fishing. This includes strengthening surveillance and enforcement, promoting sustainable fishing practices, and supporting the development of aquaculture as an alternative to wild-caught fisheries (Song, L., Garnaut, R., Fang, C. and Johnston, L. eds. (2016).

9.4 Marine Environmental Protection: China has been addressing marine pollution through policies and regulations. Efforts have been made to control land-based sources of pollution, improve wastewater treatment, reduce industrial discharges, and strengthen marine pollution emergency response systems. However, while the blue economy continues to develop, the ecological environments of the coastal and offshore areas are also facing increasing pressure (Halpern et al., 2008); more than 87 % of the ocean area has been directly affected by humans (Watson et al., 2018). This pattern of ocean contamination can be attributed to urban sewage contamination (Muniz, da Silva, Bícego, Bromberg, & Pires-Vanin, 2015), agricultural non-point source pollution (Esen & Uslu, 2008), coastal industrial wastes (El Zrelli et al., 2019), leisure and entertainment (Davenport & Davenport, 2006), and transportation (Walker et al., 2019). China has been actively working to reduce marine pollution from various sources, including industrial discharges, shipping activities, and offshore oil and gas exploration. Measures have been taken to improve wastewater treatment, regulate pollutant emissions, and enhance oil spill response capabilities. Some of the key elements of China's maritime environment strategy as of that time:

9.5 Coastal Zone Management: China has implemented policies and regulations to manage and protect its coastal zones, including the establishment of marine protected areas (MPAs), wetland conservation, and restoration efforts. The aim is to balance economic development with environmental protection in these ecologically sensitive areas and for the said purpose they also set a bed of SEZs near coastal areas (Aijaz, U., Hassan Daud Butt, D. S. B., Hayat, A., Raees, M. B., & Mazhar, M. (2022).

9.6 Ecosystem Conservation: China recognizes the importance of conserving marine ecosystems and biodiversity. Efforts have been made to protect and restore coral reefs, mangroves, and other coastal habitats. Conservation initiatives also extend to endangered species, such as the Chinese white dolphin and the giant panda of the sea. China has implemented large-scale mangrove restoration projects along its coastlines. These initiatives involve planting mangrove saplings, restoring degraded mangrove areas, and creating suitable habitats for mangrove growth. For example, in the southern province of Guangxi, extensive efforts have been made to restore mangrove forests in areas such as the Beihai Mangrove National Nature Reserve. China has enacted environmental regulations and policies to protect mangroves and promote sustainable practices. These regulations include measures to control land reclamation, regulate industrial activities near mangrove areas, and restrict the use of harmful chemicals in agriculture and aquaculture. These efforts reflect China's commitment to preserving mangrove ecosystems and their biodiversity.

However, continued vigilance and proactive measures are necessary to address the ongoing threats to mangroves, such as habitat loss, pollution, and climate change, and to ensure their long-term sustainability.

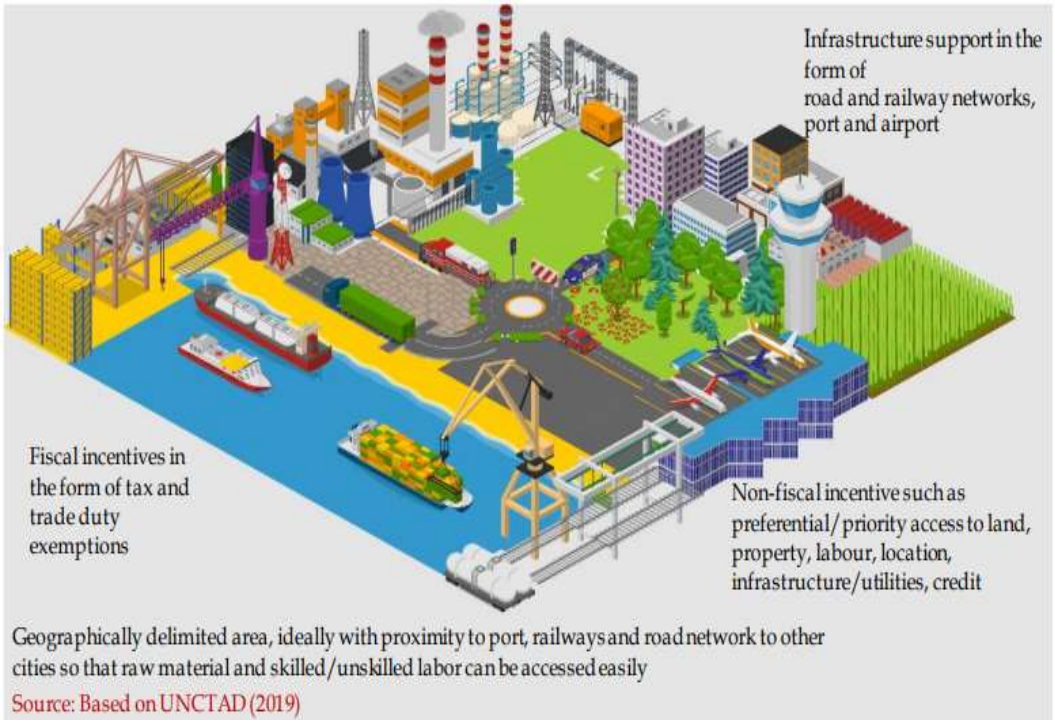
9.7 Sustainable Fisheries: China has implemented measures to promote sustainable fisheries practices, including the regulation of fishing activities, the establishment of no-fishing zones, and the promotion of aquaculture as an alternative to wild capture fisheries. The goal is to ensure the long-term viability of fish stocks and support the livelihoods of fishing communities. Aquaculture Development: China is the largest producer of aquaculture products in the world (Abinyi, M., Wu, A., Lau, S., Mallory, T., Barclay, K., Walsh, K., & Dressler, W. , 2021). The country has placed significant emphasis on the development and modernization of its aquaculture industry to meet domestic demand and support exports. This includes promoting the use of advanced technologies, improving breeding techniques, and enhancing the efficiency and sustainability of aquaculture operations. Additionally, China has implemented measures to regulate and manage its marine fisheries to ensure sustainable resource utilization. This includes setting fishing quotas, implementing fishing moratoriums in certain areas during sensitive periods, and establishing no-fishing zones to protect important breeding grounds and ecologically sensitive areas. China has recognized the importance of protecting and conserving fishery resources and ecosystems. Efforts have been made to combat illegal, unreported, and unregulated (IUU) fishing activities, strengthen surveillance and enforcement measures, and promote sustainable fishing practices to minimize bycatch and habitat degradation.

9.8 Maritime SEZs and Coastal management: China has been implementing various strategies and initiatives to develop its maritime sector, including the establishment of Special Economic Zones (SEZs) and the implementation of comprehensive coastal zone and port management measures. These efforts aim to promote economic growth, enhance coastal sustainability, and improve the efficiency and competitiveness of China's ports.

Maritime Special Economic Zones (SEZs) are designated areas within coastal regions that offer specific incentives and benefits to attract domestic and foreign investment in maritime-related industries and activities. These SEZs are designed to leverage the strategic location of coastal areas, promote maritime trade, facilitate port development, and foster economic growth.China has designated several SEZs in coastal areas to attract foreign investment, foster economic development, and promote international trade. These zones offer preferential policies and incentives to businesses, creating favorable conditions for industries related to the maritime sector. Examples of notable SEZs in coastal regions include Shenzhen, Shanghai Pudong, and Tianjin. China recognizes the importance of effective coastal zone management to ensure sustainable development and protect the coastal environment. It has established comprehensive policies and regulations to manage coastal areas, including land use planning, environmental protection measures, and the preservation of coastal ecosystems. Integrated Coastal Zone Management (ICZM) approaches are implemented to balance economic development with ecological conservation which definitely act as a stimulus to economic prosperity (Butt, H. D., Aijaz, U., & Ahmed, R., 2021).

Originally, Maritime economic zones were set up in the most strategic locations. Construction of such SEZs will be developed to have larger spatial dimensions, complex structures, more comprehensive high-tech orientation, and flexible locations. The approach toward such SEZ will reflect a strong commitment, pragmatic approach, and dynamic learning toward economic zones adopted by B.T., which are critical components of a strategic zones policy (refrence). These SEZ have specific boundaries that carry out economic functions such as export processing activities, logistics, cement , steel , bitumen, cables and wires, glass, tiles, storage, assembly, sorting, packing, distributing, and repairing or rebuilding, and industrial engineering , manufacturing and technology. This encourages

value-added processing activities and exports. They are to be situated in strategic positions and will be supported by well-developed external infrastructure. Additionely, MSEZS can be supported by facilities such as dry-ports and logistics like second-generation EPZs that focus on processing activity but are characterized by large size and extended facilities and services in promotion of a Mritime sector. aritime SEZs aim to streamline trade processes and facilitate import-export activities. They offer simplified customs procedures, reduced bureaucratic hurdles, and efficient logistics services. These measures help attract businesses engaged in international trade, boosting the export-import sector and promoting economic competitiveness. Maritime SEZs often include industrial clusters specializing in maritime-related industries such as shipbuilding, ship repair, marine engineering, offshore services, marine equipment manufacturing, and maritime logistics. Clustering maritime industries in close proximity fosters collaboration, economies of scale, and knowledge sharing, leading to increased efficiency and competitiveness.



China has established several Maritime Special Economic Zones (SEZs) to leverage its coastal advantages, promote maritime trade, and facilitate economic growth. Here are some notable maritime SEZs in China (Yitao, T., & Meng, L. , 2016):

Shenzhen Special Economic Zone: Located in Guangdong Province, Shenzhen SEZ is one of the earliest and most successful SEZs in China. It serves as a major maritime hub, home to the Port of Shenzhen, which is one of the busiest container ports in the world. Shenzhen SEZ focuses on high-tech industries, manufacturing, logistics, and international trade.

Shanghai Free Trade Zone: The Shanghai Free Trade Zone encompasses multiple areas, including the Shanghai Waigaoqiao Free Trade Zone, the Yangshan Free Trade Port Area, and the Pudong Airport Free Trade Zone. It is strategically located at the mouth of the Yangtze River and includes the Port of Shanghai, the world's largest container port. The Shanghai Free Trade Zone promotes trade, financial services, logistics, and technological innovation

Hainan Free Trade Port: Hainan Province has been designated as a Free Trade Port by the Chinese government, aiming to transform the entire island into a globally influential

free trade hub. The Hainan Free Trade Port focuses on sectors such as tourism, modern services, high-tech industries, and cross-border e-commerce. It aims to enhance trade connectivity, investment facilitation, and the flow of goods and services.

Xiamen Special Economic Zone: Xiamen SEZ, located in Fujian Province, is known for its deep-water port and strategic location near Taiwan. It serves as a gateway for trade and investment between China and Southeast Asia. Xiamen SEZ focuses on industries such as electronics, machinery, petrochemicals, and logistics.

Dalian Bonded Zone: The Dalian Bonded Zone, situated in Liaoning Province, is an important maritime SEZ in Northeast China. It includes the Dalian Port, which is a major international shipping hub. The zone promotes trade, logistics, and manufacturing, with a focus on industries like automobile manufacturing, petrochemicals, and high-tech equipment.

Tianjin Port Free Trade Zone: The Tianjin Port Free Trade Zone is located in Tianjin Municipality, adjacent to the Port of Tianjin, one of China's largest ports. The zone prioritizes logistics, international trade, advanced manufacturing, and financial services. It aims to attract investment and promote trade facilitation in the northern region of China.

These maritime SEZs, along with others across China, play a crucial role in enhancing trade, attracting investment, promoting industrial development, and fostering economic growth in their respective regions. They serve as important platforms for international trade, logistics, and technological innovation, contributing to China's position as a global maritime powerhouse(Nazarpour, M., & Shirin, Z. B. , 2017).

9.9 Port Management: China's port management practices focus on enhancing efficiency, capacity, and competitiveness. The country has made significant investments in developing modern and well-equipped port infrastructure, including container terminals, bulk cargo handling facilities, and specialized ports for specific industries. Port operations are streamlined through advanced technologies, digitalization, and automation, resulting in improved logistics and supply chain management. China has also been promoting green and sustainable practices in its ports. This includes measures to reduce emissions, improve air and water quality, and minimize the environmental impact of port operations. Efforts are made to adopt clean energy sources, promote energy efficiency, and implement waste management and recycling programs within port areas China has made significant investments in developing modern and efficient ports, several of which are considered among the most advanced in the world. Some of the most modern ports in China and the reasons for their prominence are:

Port of Shanghai: The Port of Shanghai is the largest and busiest container port in the world. It comprises several terminals, including Yangshan Deep Water Port, Waigaoqiao Port, and Wusongkou Port. The port's modern infrastructure, advanced container handling capabilities, and strategic location at the mouth of the Yangtze River have contributed to its prominence. It serves as a vital gateway for China's international trade and is a major transshipment hub for the region.

Port of Shenzhen: The Port of Shenzhen is another major container port in China, located in the Pearl River Delta region. It consists of several terminals, including Yantian Port and Shekou Port. The port is known for its extensive container handling facilities, efficient logistics operations, and its proximity to major manufacturing centers in Southern China. It has played a crucial role in facilitating China's export-oriented economy.

Port of Ningbo-Zhoushan: The Port of Ningbo-Zhoushan is a rapidly growing port located in Zhejiang province. It is currently the world's third-largest container port. The port

benefits from its deep-water channels, well-developed infrastructure, and state-of-the-art container terminals. It serves as a key transportation hub for the Yangtze River Delta region and plays a crucial role in China's foreign trade.

Port of Qingdao: The Port of Qingdao, located in Shandong province, is one of the busiest ports in Northern China. It has modern container terminals, advanced logistics facilities, and well-established shipping connections. The port's strategic location on the Yellow Sea and its well-developed transportation network contribute to its importance as a major trade gateway.

Port of Tianjin: The Port of Tianjin is one of China's largest ports and serves as a vital gateway for international trade in Northern China. It includes several terminals, such as Tianjin Port Container Terminal and Tianjin Port International Cruise Terminal. The port's deep-water berths, efficient operations, and its proximity to Beijing and other major cities make it a crucial transportation hub for the region.

China has been actively promoting the development of green ports as part of its efforts to enhance environmental sustainability and reduce the environmental impact of port operations. Green ports focus on implementing eco-friendly practices, reducing emissions, improving energy efficiency, and adopting sustainable technologies. Green ports in China prioritize the reduction of air pollution and emissions from port activities. Measures include the use of cleaner fuels, shore power systems to provide electricity to docked vessels instead of running their engines, and the installation of advanced air pollution control technologies. These efforts help improve local air quality and mitigate the environmental impact of port operations. China's green ports emphasize energy efficiency and encourage the adoption of renewable energy sources. Ports implement energy management systems, optimize energy usage, and explore the use of solar power, wind energy, and other renewable sources to meet their energy needs. Energy-saving technologies, such as LED lighting and smart grid systems, are also implemented to reduce energy consumption and improve overall efficiency. The Government has prioritized effective waste management practices. This includes implementing recycling programs, proper disposal of hazardous materials, and encouraging waste reduction and separation at the source. Port authorities work closely with stakeholders to ensure compliance with waste management regulations and promote sustainable waste handling practices within port areas. Green port development in China takes into account eco-friendly infrastructure and design principles. This includes the use of sustainable construction materials, designing ports to minimize environmental impact, and incorporating green spaces and vegetation within port areas. Nature-based solutions, such as the integration of wetlands and green buffers, are also considered to enhance biodiversity and promote ecological balance. These green ports are aligned with the country's broader sustainability goals and demonstrate its commitment to promoting environmentally responsible port operations. These initiatives not only contribute to local environmental protection but also support global efforts to mitigate climate change and advance sustainable development in the maritime sector.

By focusing on Maritime sector modernization, China aims to bolster its maritime sector, stimulate economic growth, and ensure the sustainable and efficient use of coastal resources. These initiatives contribute to China's overall goal of becoming a leading maritime nation and maintaining its position as a global economic powerhouse. Overall, China is pursuing its Blue Economy goal inside the national development agenda and the Maritime Silk Route is an instrument towards achieving that. This method is more in line with the ocean economy's simple accounting, which includes all sectors of the economy that operate in or are dependent upon the marine environment (Ye, Q., Qijiao, S., Xiaofan, Z., Shiyong, Q., & Lindsay, T, 2020). China's leadership has displayed a commitment to preserving mangrove ecosystems and their biodiversity. However, continued vigilance and proactive measures are necessary to address the ongoing threats to mangroves, such as habitat loss, pollution, and climate change, and to ensure their long-term sustainability. The Chinese experience gives various lessons on how the growth of the Blue Economy can both boost prosperity and enhance marine resources,

while the Chinese model of the Blue Economy offers ideas for using the country's marine resources. China's green ports are aligned with the country's broader sustainability goals and demonstrate its commitment to promoting environmentally responsible port operations. These initiatives not only contribute to local environmental protection but also support global efforts to mitigate climate change and advance sustainable development in the maritime sector. This model provides a framework for assessing and guiding the development of a green-blue economy, taking into account various sectors, environmental considerations, and governance aspects. It highlights the interconnectedness and interdependencies between different dimensions, emphasizing the need for integrated approaches and collaborative efforts to achieve sustainable coastal and ocean management.

10. Leveraging CPEC for Blue Growth

The China-Pakistan Economic Corridor (CPEC) offers significant opportunities for Pakistan to improve its blue economy and harness the potential of its coastal resources. Here are some ways CPEC can contribute to the development of Pakistan's blue economy:

Maritime Infrastructure Development: CPEC includes the development of port infrastructure and coastal connectivity, which can enhance Pakistan's capacity for maritime trade and transportation. Upgrading ports, building container terminals, and improving coastal infrastructure will facilitate efficient logistics, attract shipping lines, and promote maritime activities.

Fisheries and Aquaculture: CPEC can support the growth of Pakistan's fisheries and aquaculture sectors. Chinese investment and expertise can help modernize fishing practices, promote sustainable aquaculture techniques, and facilitate value addition in seafood processing. This can enhance productivity, export potential, and the overall contribution of the fisheries sector to the blue economy.

Coastal Tourism Development: CPEC projects can contribute to the development of coastal tourism in Pakistan. Improved infrastructure, such as resorts, hotels, recreational facilities, and transportation networks, can attract domestic and international tourists to the country's scenic coastal areas. This can generate employment, foreign exchange earnings, and promote sustainable tourism practices.

Renewable Energy Generation: CPEC emphasizes the development of renewable energy projects, including wind and solar power, along the coastal regions of Pakistan. This can contribute to a clean and sustainable energy mix, reducing reliance on fossil fuels. Renewable energy projects can create job opportunities, promote investment, and mitigate the environmental impacts of energy generation on the coastal ecosystem.

Blue Technology and Research Collaboration: CPEC can facilitate collaboration between Pakistani and Chinese institutions in the field of blue technology and research. This can involve knowledge sharing, joint research projects, and technology transfer in areas such as marine biotechnology, oceanography, marine resource management, and coastal ecosystem conservation. Such collaborations can lead to innovation, capacity building, and sustainable practices in the blue economy.

Maritime Training and Skill Development: CPEC offers opportunities for maritime training and skill development programs. Cooperation with Chinese institutions and companies can provide training opportunities for Pakistani professionals in areas like port management, maritime logistics, maritime law, and marine engineering. This can enhance the capabilities of the local workforce and ensure the availability of skilled personnel for the growing maritime industry.

Environmental Conservation and Sustainable Practices: CPEC projects can incorporate environmental conservation and sustainable practices to protect coastal ecosystems. This can include measures to minimize pollution, promote responsible waste management, and implement environmental impact assessments. Sustainable practices can safeguard marine biodiversity, protect coastal habitats, and ensure the long-term sustainability of the blue economy.

By leveraging the opportunities provided by CPEC, Pakistan can unlock the potential of its coastal resources, promote sustainable practices, and enhance the contribution of the blue economy to economic growth and development. Close collaboration with Chinese partners, effective policy frameworks, and investment in human capital will be crucial for realizing the benefits of CPEC for Pakistan's blue economy.

11. Future Implications:

It is feasible to build a greater knowledge of the connection between CPEC and the growth of the blue economy by overcoming these constraints through rigorous techniques, multidisciplinary approaches, and researcher collaboration. The potential advantages and difficulties of CPEC projects for marine and coastal ecosystems, as well as their socioeconomic effects, may be identified with the aid of this research. In addition, studies on using CPEC for blue development may help with policy formation and well-informed decision-making. It can offer advice that are supported by data on how to maximize CPEC's benefits for the blue economy while minimizing any possible drawbacks. This study can inform policies for sustainable development, advance environmental protection, and encourage inclusive and equitable growth in coastal areas. Overall, research on Chinese blue development and utilizing CPEC has considerable promise for improving our comprehension of the interaction between economic development, environmental sustainability, and the blue economy despite the inherent limits.
We can work to build a balanced and sustainable approach to blue economy growth in the context of CPEC and beyond through ongoing study and collaboration. Given that the blue economy is a worldwide issue, further study in this area can also benefit international knowledge exchange and collaboration. Researchers can find lessons that can be implemented in other places with comparable difficulties and possibilities by studying China's experiences and best practices.

The finding has several future directions in leveraging the China-Pakistan Economic Corridor (CPEC) for sustainable blue economy and coastal growth. Evaluating the performance of integrated coastal zone management techniques within the context of CPEC. It is possible to do research on governance frameworks, stakeholder involvement, and the inclusion of environmental, social, and economic factors in decision-making must be considered in future studies. Additionally, future research ought to assess the potential of sustainable aquaculture and responsible fisheries practices in coastal areas along the CPEC route. So the researchers can explore the environmental and socio-economic benefits of sustainable seafood production, including resource management, market access, and value chain development. In addition, promote sustainable coastal development and solve shared difficulties, nations participating in the BRI and GDI are analyzing prospects for regional collaboration, knowledge sharing, and best practice exchanges should be considered in future studies. However, investigating the role of blue carbon ecosystems, such as mangroves, sea grasses, and salt marshes, in carbon sequestration and their integration into climate change mitigation strategies under CPEC. Future research can focus on quantifying carbon stocks, assessing ecosystem services, and exploring financial mechanisms for their conservation and restoration. Also, future research also should investigate how vulnerable coastal ecosystems, communities, and infrastructure are as well as suggest creative ways to improve resilience.

12. Conclusion

The above study on Chinese blue development and leveraging the China-Pakistan Economic Corridor (CPEC) offers a valuable opportunity to understand the potential impacts and opportunities for sustainable growth in the marine and coastal sectors. While there may be limitations in terms of data availability, time constraints, complex interactions, data quality, and political sensitivities, conducting research in this area can still provide valuable insights.
Several deficiencies have been observed when the institutional capability for sustainable blue economy governance and the existing policies and regulations relating to coastal development in Pakistan are evaluated. Numerous obstacles stand in the way of Pakistan's blue economy's development through the China-Pakistan Economic Corridor (CPEC). However, there may be ways to overcome these issues and advance the growth of a sustainable blue economy. Firstly, developing comprehensive and integrated policies that take into account environmental sustainability, economic growth, social inclusion, and governance will strengthen the policy framework surrounding the blue economy. Secondly, to encourage the ethical and sustainable use of marine resources, clear legislation, standards, and incentives may need to be established. Thirdly, to improve the abilities and knowledge of people and organizations participating in the blue economy sector, invest in capacity building programs, training, and knowledge sharing initiatives. Training in sustainable fishing methods, marine conservation, and aquaculture management are some of these.

These gaps could obstruct efficient coastal management and the shift to a blue economy that is sustainable. Firstly, address the lack of enforcement and compliance by implementing stricter monitoring, inspections, and penalties for violations. This will ensure that development activities adhere to environmental regulations and prevent unauthorized practices (Hussain & Bhatti, 2023). Similarly, the improvement of local communities', indigenous groups', and other pertinent stakeholders' participation in decision-making processes. Campaigns to raise awareness, programs to improve capacity, and the creation of regional coastal management committees can all help with this. Their recommendations and traditional knowledge ought to be taken into consideration while creating and implementing policies (Noman et al., 2022). Additionally, recognize and address the impacts of climate change on coastal areas through the integration of climate change adaptation and resilience measures into policies and regulations. This can include setback regulations, shoreline protection, and sustainable coastal engineering practices to mitigate the effects of rising sea levels and increased storm intensity (Iqbal et al., 2022).

Moreover, improve the systems for cooperation between the many government departments, industries, and others involved in coastal development and the blue economy. To ensure sound decision-making, effective resource allocation, and conflict avoidance, strengthen partnerships, encourage information exchange, and encourage teamwork (Fida et al., 2022). In addition, allocate sufficient resources for monitoring and research to gather reliable data on the state of the coastal environment, its resources, and the impacts of human activities. This will provide a foundation for evidence-based decision-making, policy evaluation, and adaptive management approaches (Iqbal et al., 2022). While, Pakistan can achieve more sustainable coastal development practices, safeguard its coastal ecosystems, and promote a responsible and robust blue economy by filling these gaps and putting the suggested solutions into effect.

13. Summary of key Findings and Contributions of the Research Paper:

The research purpose has to leverage the China-Pakistan Economic Corridor (CPEC) to foster a sustainable blue economy and coastal growth, which offers Pakistan a rare chance to harmonize its development objectives with the values of sustainability and environmental care. The larger Belt and Road Initiative (BRI) and Global Development Initiative (GDI), of which CPEC is a part, can play a significant role in boosting economic growth, supporting sustainable development practices, and assuring the long-term sustainability of coastal ecosystems. Additionally, Pakistan may utilize its coastal resources for sustainable economic growth by incorporating the blue economy's tenets into CPEC

projects. Adopting policies and regulations that place an emphasis on ethical fishing methods, environmentally sound aquaculture, the construction of coastal infrastructure, and environmental protection is necessary to achieve this. Collaboration with China, a significant CPEC partner, can make it easier to transfer technology, build capacity, and exchange information in various fields, encouraging best practices and innovation. In addition, sustainable development through CPEC requires careful consideration of the environmental impacts of infrastructure development and economic activities along the coastal areas. It is crucial to conduct comprehensive environmental impact assessments (EIAs) for all CPEC projects, ensuring adherence to national and international environmental standards. Additionally, robust monitoring and enforcement mechanisms should be established to mitigate and address any potential negative impacts on coastal ecosystems.

Furthermore, the local population, indigenous groups, and pertinent stakeholders must actively engage in and participate in sustainable coastal growth. To ensure social equality, cultural preservation, and economic inclusivity, their participation in decision-making processes, capacity-building efforts, and benefit-sharing systems is crucial. Also, Pakistan can increase its climate change resistance, preserve its unique coastal biodiversity, and open up economic opportunities for coastal residents by using CPEC as a platform for sustainable blue economy and coastal growth. While promoting a harmonious balance between economic success and environmental preservation, the incorporation of sustainability concepts into CPEC projects would help to accomplish national and international sustainable development goals. Lastly, Pakistan must make the most of this chance to develop and put into effect policies that emphasize sustainable practices, bolster institutional capacity, and promote regional collaboration. By doing this, Pakistan may establish itself as a regional pioneer in ecologically friendly coastal development, support international efforts to combat climate change, and pave the road for a prosperous and sustainable future.

14. Policy Recommendations for Leveraging CPEC for the Sustainable Blue Economy and Coastal Growth

Pakistan has a lot to gain by utilizing the China-Pakistan Economic Corridor (CPEC) for a sustainable blue economy and coastal prosperity. The most significant CPEC project intends to improve infrastructure development, connectivity, and economic cooperation between China and Pakistan. CPEC can be efficiently used to advance a sustainable blue economy and encourage coastal growth. Some policy recommendations are as follows:

- Pakistan should have to create an organized blue economy strategy that supports CPEC's objectives.
- Fisheries, aquaculture, maritime transportation, renewable energy, tourism, and the construction of coastal infrastructure should all be included in this approach.
- Dire need to revise Vision 2025 and incorporate Blue Economy as one of its pillar.
- Existing Laws and regulations need to be changed in line with the BE governance and management requirements.
- Up gradation is required to Integrated Coastal Zone Management Plans in the light of BE Development Policy.
- It should place a strong emphasis on environmentally friendly methods, resource preservation, social equity, and climatic resilience.
- Relevant parties should be involved in the strategy's formulation through a participatory process, including local communities, governmental organizations, businesses, and international partners.
- Similarly, for coastal prosperity, the fisheries and aquaculture sectors should be strengthened. Promoting sustainable fishing practices, such as ethical fishing techniques, combatting illicit, unreported, and unregulated (IUU) fishing, and

preserving the long-term survival of fish stocks should be the main objectives of policies. It will also improve the sector's economic and environmental sustainability to assist the development of sustainable aquaculture, which includes ethical farming practices, enhanced water quality management, the use of appropriate feed, and disease control methods.

- Update National Policy & Strategy for Fisheries & Aquaculture Development 2007.
- Formulation of single body to for the registration & licensing of Vessels/ fishing boat.
- Additionally, collaboration with China through CPEC offers a chance for technology transfer and the development of industry capacity. Knowledge sharing, training initiatives, and technology transfer should be prioritized in fields including sustainable fishing methods, aquaculture techniques, maritime transport management, renewable energy options, and coastal environment preservation. Through this partnership, Pakistan's institutional capacity will be increased, and local stakeholders will be better prepared to support sustainable coastal expansion.
- Projects under the CPEC should prioritize environmental protection. All coastal development projects should be subject to strict environmental impact assessments (EIAs) to ensure compliance with local, state, federal, and international environmental regulations.
- To stop and lessen environmental degradation, effective monitoring and enforcement systems should be set up. Through the establishment of protected areas and restoration programs, emphasis will be placed on the conservation of delicate coastal ecosystems like mangroves, coral reefs, and sea grass beds, which will support sustainable coastal development and biodiversity preservation.
- Moreover, CPEC presents a chance to strengthen interregional cooperation in the field of the blue economy. In order to create cooperative initiatives for sustainable marine resource management, research collaboration, and information exchange, Pakistan should work with its neighbors, especially those in the Indian Ocean region. Regional collaborations can address transnational issues, stop illegal fishing, and improve connectivity and sustainable maritime trade. Furthermore, initiatives promoting the blue economy must have the support of the private sector to succeed. Policies should foster an atmosphere that encourages private sector investment in tourism, fisheries, aquaculture, and coastal development.

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