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Developing an ocean governance regime for China-Pakistan economic corridor: a comparison of the marine environmental legislation and policy framework by utilizing CRILL methodology

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Bilateralism in ocean governance is a novel concept that can be developed under the existing International Environmental Law (IEL) and United Nations Convention on the Law of the Sea (UNCLOS). This research paper suggested that bilateralism in ocean governance is one of the Agenda of Sustainable Development Goal 14 (SDG 14). This research paper utilized the methodology of a Comprehensive Review of Law and Relevant Literature (CRILL methodology) and developed a theoretical and legal framework for bilateral ocean governance with the elements of capacity building, adaptation, precautionary approach and participation. Under the given elements of CRILL methodology, this paper analyzed and compared the ocean governance mechanisms of China and Pakistan and proposed that under the China-Pakistan Economic Corridor (CPEC) of the Belt and Road Initiative (BRI), these two States can develop a bilateral framework of ocean governance for the protection of the marine environment, preservation of fisheries and mitigation of ocean acidification and sea level rise. The results of the CRILL methodology are presented in the form of a proposal that institutional coordination is essential for the effectiveness of bilateral ocean governance cooperation, which is China's regional agenda of BRI. Through such development, the two States, China and Pakistan, can share the mutual economic benefits of ocean development and can have a strong voice in the global ocean agenda.

KEYWORDS

belt and road initiative (BRI), China-Pakistan economic corridor (CPEC), climate change, CRILL methodology, ocean governance

1 Introduction

Recently, increased efforts by various States on the planning and management of the oceans have been witnessed. Numerous coastal States (even developing ones) are adopting robust and effective ocean governance mechanisms for the protection of the marine environment (Zhang et al., 2023a). With the emergence of Sustainable Development Goal 14 (SDG 14) of the 2015 United Nations Agenda (also known as Agenda - 2030 or Sustainable Development Goals – SDGs), there is a more significant global commitment to effective ocean governance (Zulfiqar and Butt, 2021).¹ This agenda also promotes multilateral (regional) and bilateral (State to State) mechanisms (agreements) for effective ocean governance (Zulfiqar and Butt, 2021). Such a call for transformation impacts the overall mechanism of ocean governance at each level, including global, regional, national, and local levels.

As the UN Agenda of Sustainable Development is based on effective governance towards sustainability, oceans, as the most significant part of global ecosystems, will significantly contribute to the SDGs. A specific goal in terms of SDG 14 for marine environmental protection, fisheries preservation, and optimum utilization of marine resources will serve to integrate the SDGs meaningfully. It is pertinent to mention that global and regional connectivity and infrastructure projects also impact the linkages between the levels of governance, which will greatly influence the implementation of SDGs. One pertinent regional (can also be referred to as global) infrastructure project, the Belt and Road Initiative (BRI), initiated by the People's Republic of China (China), consisting of two main parts, the Silk Road Economic Belt and 21st Century Maritime Silk Road, is mainly impacting the regional governance mechanisms (Butt et al., 2021a). Regarding ocean governance structures, BRI will have a more significant impact on regional, bilateral, and even national ocean governance mechanisms. Therefore, BRI's ocean governance legal frameworks have faced severe criticism, and prospective solutions have been proposed. Regional ocean governance is addressed by China in terms of cooperation and sustainable development under bilateral legal and policy frameworks as an aim of BRI (Butt and Zulfiqar, 2023).

BRI comprises several maritime routes for connecting China with other coastal States, and for such purposes, China is initiating several bilateral agreements of ocean governance (Butt and Zulfiqar, 2023). There exist several issues to be considered in bilateral ocean governance, which are still unaddressed in general and specifically under BRI's legal framework. Precisely, there is a bilateral arrangement of ocean governance between China and the Islamic Republic of Pakistan (Pakistan). China is already building roadways, railways, and maritime infrastructure projects in Pakistan under Public Private Partnership (PPP) arrangements (Butt et al., 2021a). The PPP arrangements are working under a broader framework of the Bilateral Investment Treaty (BIT) and Free Trade Agreements (FTAs) between China and Pakistan, which is also known as the China-Pakistan Economic Corridor (CPEC) (Butt et al., 2021a). For complex abbreviations and terminologies refer to Table 1. The development of such projects by China in Pakistan is already under criticism by international and national environmental organizations (Gland, 2016).

The principal criticism is about the lack of environmental protection provisions in any of the bilateral arrangements of CPEC (Wang, 2023). CPEC is the most extensive interconnectivity project in the history of Pakistan and has been and is being prematurely supervised under the generic frameworks of BITs and FTAs (Gland, 2016). CPEC is causing climate and environmental change that is impacting the oceans in terms of elevation of sea levels, increase in marine pollution, and harm to fisheries and underwater habitats due to ocean acidification (Ahmed et al., 2016). Although CPEC projects are important for ocean development in Pakistan, they also require institutional coordination with bilateral arrangements with greater environmental objectives in ocean governance (Butt et al., 2021a). As China is already a key player in global and regional ocean governance, Pakistan can seek Chinese assistance to develop its ocean governance framework under the CPEC of BRI through bilateral arrangements and cooperative mechanisms (Butt et al., 2021c). Such arrangements also ensure that marine environmental protection is integrated into infrastructural development projects and that development needs are considered in applying sustainable development objectives.

Based on this hypothesis, this research paper conducted a comparative analysis of the ocean governance framework of China and Pakistan to observe the institutional capacity of developing bilateralism in both States. The ocean governance frameworks of China and Pakistan are compared under international law with sound reasoning as to why effective implementation of the law of the sea (along with other international environmental instruments) is essential for vigorous ocean governance. This comparison followed a theoretical and legal framework under SDG 14 (as a novel and effective means of ocean governance) developed in the next section through a Comprehensive Review of International Law and Relevant Literature (CRILL – Methodology) (Butt, 2021; Butt et al., 2021b; Zulfiqar and Butt, 2021). Application of the CRILL methodology is significant for such comparative analysis because it provides a mechanism to thoroughly review the law and literature, including the suggestions for improvement.

In case of comparing China and Pakistan's ocean governance mechanisms, the CRILL methodology suggested a novel mechanism of Bilateral Ocean Governance under the existing frameworks of FTAs and BITs under the CPEC and BRI. This suggestion provided through the CRILL analysis is based on a successful example of the bilateral ocean governance mechanism of Canada and the United States of America (USA) (this example is further explained in a section below). The results after applying the CRILL methodology also suggested that bilateral ocean governance can be developed by improving the institutional coordination of both the States under the existing arrangements of CPEC and BRI. The conclusion of this research through CRILL methodology summarized the findings and also proposed the future research agenda in the field of bilateral ocean governance under BRI frameworks.

2 Research methodology – application of CRILL to develop theoretical and legal framework

Before comprehensively analyzing the institutional coordination in ocean governance frameworks of China and Pakistan, it is pertinent

¹ All the Complex Terminologies have been explained in Table 1.

TABLE 1 Explanation of terminologies used for this research paper.

Sr no	Abbreviations	Full Form	Explanation
1	IEL	International Environmental Law	IEL for this paper means the international environmental law developed after the inception of the Stockholm Declaration, including Earth Summit Documents (CBD, Rio Declaration, UNFCCC and ABNJ)
2	SDGs	Sustainable Development Goals	SDGs is also the Agenda of United Nations based on a Declaration proposing sustainability solutions in the context of global good.
3	CRILL	Comprehensive Review of Law and Literature	CRILL is a methodology applicable to review the legal literature which has been utilized by several research papers as provided in the references.
4	BRI	Belt and Road Initiative	Belt and Road Initiative is China's initiative to develop sustainable systems of international trade and regional connectivity.
5	CPEC	China-Pakistan Economic Corridor	CPEC is one important part of BRI connecting China to Asia and Africa through Pakistan.
6	UNCLOS	United Nations Convention on the Law of the Sea	UNCLOS is also known as the constitution of oceans which is globally accepted and ratified by most of the coastal states.
7	(BOG)	Bilateral Ocean Governance	Bilateral Ocean Governance is a mechanism to govern oceans between two states or where there is a mutual interest of governance.
8	BIT	Bilateral Investment Treaties	BITs are the agreements signed by two states for investment; for this paper, it refers to the agreements between China and Pakistan
9	FTA	Free Trade Agreement	FTAs are the agreements signed by two states for trade; for this paper, it refers to the agreements between China and Pakistan
10	MEAs	Multilateral Environmental Agreements	MEAs are the agreements between states for the protection of the environment. In this paper, MEAs refer to marine environmental protection agreements.

Source prepared by authors based on the terms used in this paper and explained through the references.

to understand the new means of ocean governance. The latest SDG 14 of the United Nations (UN) Agenda 2030 refers repetitively to International Environmental Law (IEL) consistent with the United Nations Convention on Law of the Sea (UNCLOS), which explicitly endorses the importance of institutional coordination of multilateral, regional, and bilateral ocean governance treaties ([Final list of proposed Sustainable Development Goal indicators, 2016](#); [Proelss, 2019](#)). The bilateral arrangements in ocean governance were previously developed under the regional Multilateral Environmental Agreements (MEAs) with an agenda of sustainable development ([Zulfiqar and Butt, 2021](#)). Therefore, a review of relevant law and literature through the CRILL methodology provides significant issues to be considered in ocean governance under bilateral arrangements.

2.1 Definition of CRILL methodology

The methodology of CRILL is basically a merger of two methods: i) review of law and ii) review of relevant literature ([Butt, 2021](#); [Zulfiqar and Butt, 2021](#)). The method utilized for reviewing the law is comparative, and reviewing the literature is analytical, based on key terms frequently used in 'ocean governance law' literature. The CRILL methodology is utilized to comprehensively analyze the law and literature, and with such inclusive analysis, precise results are produced. This methodology is adopted from two different research articles utilized to review IEL, UNCLOS, SDGs data, and relevant literature, as shown in [Figure 1](#). The methodology is initiated in

Section 2.2, explaining how this methodology is applied, and in Section 2.3, it is explained on what basis the relevant literature and law are selected. The law is reviewed in Section 2.4 after thoroughly analyzing the literature because the research provides an informative and critical perspective of the law under CRILL methodology.

2.2 Initiation of methodology

A step-by-step approach is adopted for the CRILL methodology as per following steps:

1. Search for relevant literature through various databases (including Google Scholar, Research Gate, and Web of Science). The selected databases provide the most relevant research articles on the issues related to ocean governance, SDG 14, UNCLOS, and IEL.
2. Most relevant articles, book chapters, and policy papers were selected for further review.
3. Review of extracted research articles, book chapters and policy papers envisaged elements of a theoretical framework (an institutional coordination framework) that assist authorities/institutions in ocean governance.
4. Analysis of the ocean governance frameworks of China and Pakistan, using the given elements and legal/theoretical framework.

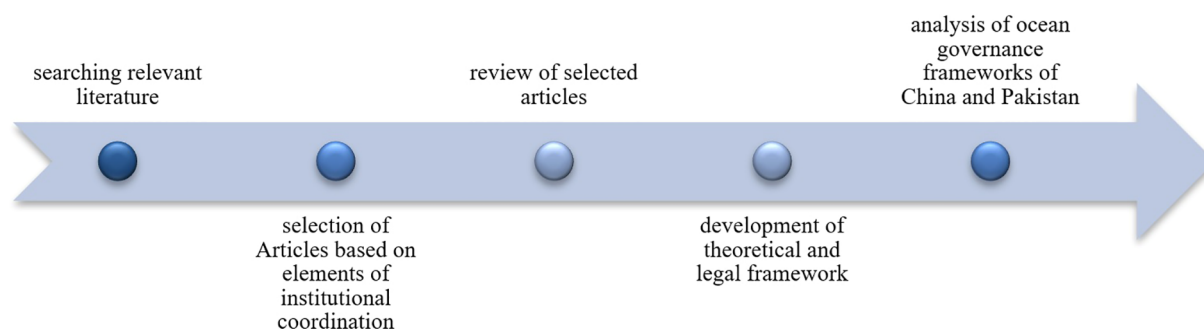


FIGURE 1

CRILL Methodology – Step by Step. Sources: Preserving Community's Environmental Interests in a Meta-Ocean Governance Framework towards Sustainable Development Goal 14: A Mechanism of Promoting Coordination between Institutions Responsible for Curbing Marine Pollution, Sustainability 13 (2021) 9983; Applicability of International Law in Development of Sustainable Port Policy: An Analysis of Good Practices and Future Policy of Gwadar Port, A Publication of International Association of Maritime Universities; and, The Role of the International Law in Shaping the Governance for Sustainable Development Goals, Journal of Law and Political Science 28 (2021) 3.

The transformation of ocean governance under SDG 14 has emerged with an ecosystem-based approach. This means that SDG 14 has envisioned a novel form of 'ocean governance' with institutional coordination mechanisms. To review the institutional coordination mechanisms of ocean governance with bilateralism, initially, the relevant IEL and UNCLOS were reviewed as provided in Table 2. This review of IEL and UNCLOS envisages a few elements for institutional coordination in ocean governance, i.e., participation, capacity-building, precautionary approach and adaptation. The given elements assisted in developing a search criterion of relevant literature in the field of ocean governance.

The timeline for deriving the literature was 2015–2024 because SDG 14 under the SDGs came into existence in 2015. Moreover, several transformations in 'ocean governance' in theory, practice, literature and law were adopted after 2015. The search terms and criterion for the application of CRILL methodology on developing a theoretical and legal framework of ocean governance are further divided into three parts because this research paper requires 'ocean governance under SDG 14 with UNCLOS and IEL', 'bilateralism in ocean governance', 'ocean governance of China', and 'ocean governance of Pakistan':

1. Ocean governance + Bilateralism + SDG 14 + UNCLOS + IEL + (participation, capacity-building, precautionary approach and adaptation).
2. Ocean governance + China + Law + (participation, capacity-building, precautionary approach and adaptation).
3. Ocean governance + Pakistan + Law + (participation, capacity-building, precautionary approach and adaptation).

2.3 Extraction of relevant literature and its relationship with IEL and UNCLOS

The findings of the reviewed literature under the search terms of ocean governance, SDG 14, IEL and UNCLOS were quite

interesting as shown in Figure 2 (also refer to Appendix). Thirty-seven articles/book chapters/policy papers on ocean governance with IEL and UNCLOS perspectives elucidated the importance of 'participation' for the effective implementation of SDG 14. Twenty-six articles/book chapters/policy papers argued that adaptation is necessary for ecosystem-based ocean governance. Thirteen articles/book chapters/policy papers suggested the transfer of technology and scientific research cooperation at bilateral levels for effective ocean governance. Twenty-seven articles/book chapters/policy papers suggested that precautionary approaches are mandatory in development projects for effective ocean governance. Nine research papers provided approaches of institutional coordination at bilateral levels in ocean governance.

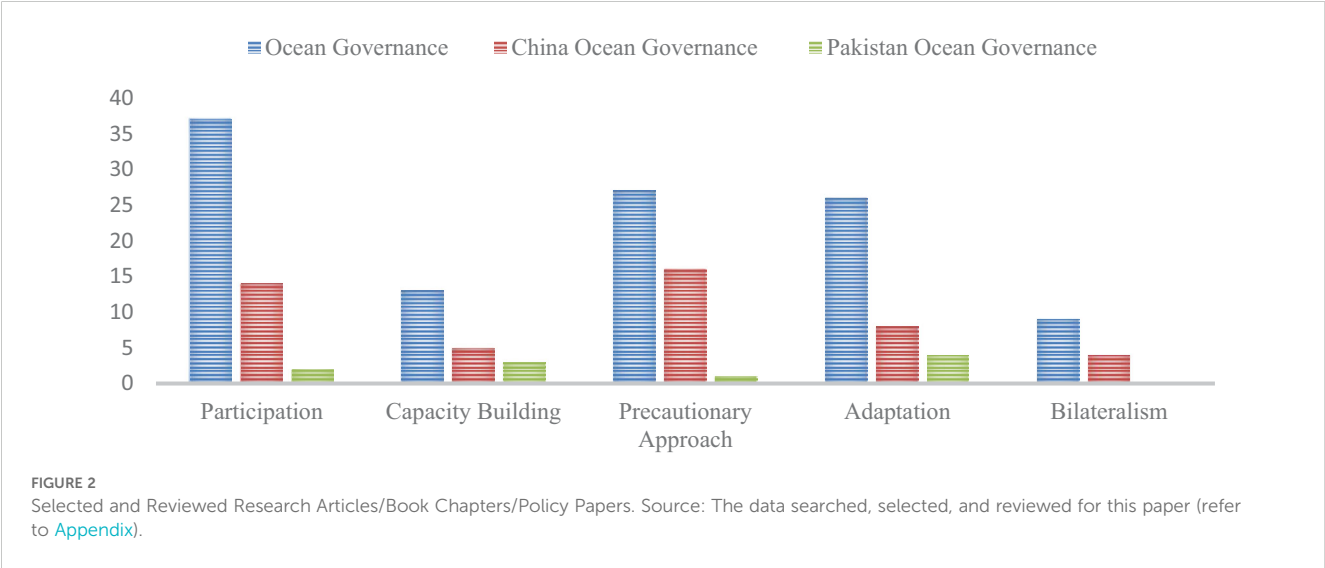
There are relatively fewer research articles and policy papers available on the topic of 'ocean governance in Pakistan'. Conversely, a lot of research and policy papers are available on the topic of 'ocean governance in China', as shown in Figure 2 (also refer to the Appendix). Fourteen research and policy papers on China's ocean governance suggest that there is institutional coordination for policy-making processes. Moreover, eight research articles argued that there exists a process of adaptation, but it is weak in addressing capacity-building issues. In terms of SDG 14, China's approaches are improving relatively for regional and bilateral cooperation in ocean governance (Figure 2). On the contrary, Pakistan is trying to enhance bilateral cooperation in general and lacks specific arrangements for capacity like ocean governance.

This means that SDG 14 has transformed mechanisms of ocean governance, including bilateral arrangements, and envisaged the importance of UNCLOS and IEL for the sustainability of oceans. In order to derive the ocean governance mechanism under UNCLOS and IEL, the final list of proposed indicators provided under SDG 14 was reviewed for interconnection. After a comprehensive review of the literature and law, several interconnections among UNCLOS, IEL, and governance elements emerged. The review of law and literature proposed the framework of institutional coordination that connects various governance mechanisms that impact an ecosystem's health and environment. This mechanism suggests

TABLE 2 SDG 14 legally binding governing authorities in bilateral ocean governance.

SDG – 14	Provisions of UNCLOS	Reviewed IEL	Other SDGs	Involvement of Authorities	Provisions on Bilateralism
1. 14.1 prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution 14.2 sustainably manage and protect marine and coastal ecosystems	Part XII in Marine Environmental Protection and Article 194 on releasing toxic, harmful or noxious substances, especially those that are persistent, from land-based sources, from or through the atmosphere or by dumping.	Part – II of the Rio Declaration and Stockholm Declaration	SDG 6 for Effective Sanitation and Waste Management And SDG 15 for the protection of overall ecosystems	Coastal Cities (municipal) authorities And/or Waste management and governing authorities Environmental Protection Agencies	Section 2 of Part XII of UNCLOS Chapter 17 of Agenda 21
2. 14.c Enhance the conservation and sustainable use of oceans and their resources (fisheries)	Articles 61 – 68, and, Section 2 of Part VII on Conservation and Management of the Living Resources	Article – 10 of CBD on Sustainable Use of Components of Biological Diversity UN Fish Stocks Agreement	SDG 2 and SDG 12 for food security and sustainable consumption	Fisheries Governing Authorities	Article 118 of the UNCLOS Article 5 of CBD
3. 14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	Article 1 is on pollution of the marine environment and Ocean’s Health, and Article 194 is on releasing toxic, harmful or noxious substances from or through the atmosphere or by dumping.	Articles – 2 and 4 of the UNFCCC on Commitments and Objectives for climate change solutions	SDG 13 for Climate Change	Climate Governing Authorities	Section 2 of Part XII of UNCLOS Articles 7 and 9 of UNFCCC

Source CRILL Methodology Results (refer to [Appendix](#)) as analyzed in Subsections 2.1 and 2.2.



that polycentricity exists in the ocean governance mechanism and that this system is multilevel (Zulfiqar and Butt, 2021). Further, the review also envisaged that there is rapid development in regional solid and bilateral mechanisms of ocean governance, the intersectoral and intra-sectoral approaches are weak due to ineffective monitoring and unstructured pollution control systems (Zulfiqar and Butt, 2021).

Most of the articles argued that an ecosystem-based approach to ocean governance requires that there should be institutional coordination among the authorities governing waste, sanitation,

fisheries, and climate (Zeren Cetin et al., 2023). This coordination is required to address the challenges faced by ocean governing authorities/institutions. In terms of bilateralism, there is foreign investment (for the development of ports, infrastructure and connectivity) and trade through routes. Therefore, bilateral agreements in terms of ocean governance should consider various challenges of the marine environment as an ecosystem. Increased activity at ports surges the population of coastal cities, which significantly increases atmospheric and land-based pollution (Kucukpehlivan et al., 2023). Such pollution impacts the

fisheries and ocean health and requires input from the given authorities/institutions.

Given that, oceans as an ecosystem are challenged by the governance of (coastal) cities (including waste and sanitation water), marine habitat (fisheries) and climate (atmospheric pollution control) (Butt et al., 2021b). SDG 14 requires significant policy reforms for institutional coordination and, more specifically, prior to any new bilateral or multilateral arrangements. This is because the SDG 14 basic objectives are: i) marine pollution prevention, ii) preservation of fisheries and iii) mitigation of ocean acidification and coastal flooding (from climate change activities) (Cetin, 2020). Moreover, any new arrangement shall comprise capacity building, participation, adaptation, and precautionary measures. The subsection below further explains the given elements. Based on the given arguments, the next subsection developed a legal and theoretical framework as per the given process of the CRILL methodology. The following subsection is developed to analyze the existing mechanisms of ocean governance of China and Pakistan, in order to argue better why a bilateral ocean governance mechanism is required.

2.4 Methodology towards developing a theoretical and legal framework

Under SDG 14, the broad objectives of ocean governance are to identify the other governance mechanisms impacting overall marine ecosystems (including marine environment, fisheries and habitat) (Cormier and Elliott, 2017). The implementation plan of SDG 14 operates the objectives of ocean governance with various governance mechanisms, including governance of coastal cities (waste and sanitation), climate (air pollution control), and fisheries (Zulfiqar and Butt, 2021; Zhang et al., 2023a). Basically, SDG 14 identifies other governance mechanisms impacting marine ecosystems as diverse and challenging patterns. Therefore, SDG 14 provides a guide for the implementation of ocean governance with diverse actors under one (integrated/ecosystem-based) framework (Gulseven, 2020). This highlights the importance of institutional coordination for bilateralism in ocean governance with effective monitoring and structured pollution control systems.

While envisioning the broad objectives of ocean governance and stating that there shall be involvement of other governing authorities, SDG 14 connects with other SDGs of the Agenda 2030 (Final list of proposed Sustainable Development Goal indicators, 2016). The provisions of UNCLOS and IEL clearly state bilateral and multilateral cooperation and cross-border institutional coordination. In this way, SDG 14, while referring to legally binding IEL along with UNCLOS, provides that the States signatory to these instruments shall incorporate such measures in ocean governance for the protection of marine ecosystems (Mao et al., 2019). The legally binding UNCLOS and IEL provisions under SDG 14 and other SDGs for involving various governing authorities are mentioned below (and also shown in Table 2):

1. SDG 14.1 and 14.2 for the prevention and significant reduction of marine pollution of all kinds, in particular

from land-based activities, including marine debris and nutrient pollution and sustainable management of ocean and protection of marine and coastal ecosystems, establishes a connection with Part XII of UNCLOS and Section of the United Nations Declaration on Human Environment (Stockholm Declaration) and Part II of the Declaration on Environment and Development (Rio Declaration or Agenda 21) (Declaration of the United Nations Conference on Environment and Development/Rio Declaration on Environment and Development, 1992).

2. 14.c Enhancing conservation and sustainable use of oceans and marine resources is a legal obligation under Articles 61–68 of UNCLOS and Article 10 of the Convention on Biological Diversity (CBD) (Convention on Biological Diversity, 1992). Fisheries as a significant marine resource is also addressed (with preservation purposes) in the Agreement Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UN Fish Stocks Agreement) and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Agreement for the implementation of the provisions of the united nations convention on the law of the sea of 10 december 1982 relating to the conservation and management of straddling fish stocks and highly migratory fish stocks, 1995; (Convention on international trade in endangered species of wild fauna and flora 1973 (Enforced 1975)), n.d.).
3. 14.3 Addressing the impacts of ocean acidification is a legal obligation under Article 1 of the UNCLOS and an essential component of the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol and Paris Agreement (United Nations Framework Convention on Climate Change, 1992; Kyoto Protocol to the United Nations Framework Convention on Climate Change, 1997; Paris Agreement).

The challenges, patterns and objectives of SDG 14 reflect the idea of involving multiple stakeholders in ocean governance (Haward and Haas, 2021). Therefore, SDG 14 suggests the capacity development of various governmental institutions/authorities for effective monitoring and accountability of industrial and business stakeholders in ocean governance (Final list of proposed Sustainable Development Goal indicators, 2016). Industrial and business entities involved in ocean governance work in private and public domains (Environmental Protection Law of the People's Republic of China Environmental Legislation in China, 2004). Some governmental authorities are directly involved in ocean governance, for example, the Environmental Protection Agency (EPA) of both Pakistan and China, and authorities for the governance of fisheries (Ahsan and Khawaja, 2013). Some governmental authorities are indirectly involved in ocean governance, such as waste and sanitation authorities or management corporations of coastal cities and climate governing authorities for air pollution control (Zulfiqar and Butt, 2021). SDG 14 with objectives refers to the UNCLOS and IEL, which

develop a network among the authorities and stakeholders mentioned above. The IEL provides elements of ocean governance that help develop and maintain such networks. The elements are participation, capacity building, precautionary approach and adaptation (Zhang et al., 2023b). Therefore, these elements operating under SDG 14 develop a holistic, integrated, ecosystem-based governance system that protects marine ecosystems. As mentioned above, the elements of IEL and UNCLOS are provided below (as shown in Figure 3):

1. Participation in the decision-making process is the basic element of IEL for institutional coordination, which allows various stakeholders to secure their interests while keeping sustainability intact in ocean governance (Coenen, 2009; Butt, 2021). Bilateral arrangements for institutional coordination in the decision-making process are important to observe the existing conditions of oceans and marine environment. Such bilateralism has been endorsed by the CBD and the United Nations Convention on Access to Information, Participation in Decision-making and Access to Justice (Aarhus Convention). Both the IEL Conventions call for participation to control, mitigate and prevent adverse environmental impacts (Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, 1998). The UNCLOS also urge participation in the protection of the marine environment. SDG 14 connects the UNCLOS, CBD and Aarhus Convention for the purposes of participation in ocean governance (Zulfikar and Butt, 2021).
2. Capacity building in ocean governance allows various governmental authorities to address technical issues and other (non-governmental) environmental organizations (NGOs) to balance ocean sustainability and the economic/development perspective insight. Bilateralism under SDGs means the transfer of technology, capacity and technical ability, which are significant parts of capacity building. Soft law declarations, including the Stockholm Declaration and Rio Declaration, provide the element of capacity institutions for effective ocean governance for the protection of marine ecosystems (Zhang et al., 2023b).
3. Precautionary Approach(es) in all means of governance, which includes governance of coastal cities (waste and sanitation management), fisheries and climate, is necessary because all these governance mechanisms impact overall marine ecosystems (Zhang et al., 2023b). Under the UNCLOS, precautionary measures are taken while developing infrastructure under bilateral arrangements and also include ocean development (such as Fisheries). Moreover, the CBD, Aarhus Convention, Rio Declaration and Stockholm Declaration urge the States to develop local waste and sanitation management mechanisms (Zulfikar and Butt, 2021; Zhang et al., 2023b). UNFCCC and its Paris Agreement and Kyoto Protocol provide that States should incorporate air pollution control mechanisms in

Environmental Impact Assessment (EIA) mechanisms, which include carbon and greenhouse gas emissions from industries and traffic (Baird et al., 2009).

4. Adaptation in ocean governance means realizing that all ecosystems, including terrestrial, air, and marine, are interconnected and integrated (Butt, 2021). Therefore, a broader system of environmental governance with effective monitoring, accountability, and transparency is required to address the environment in general and the marine environment specifically. At a bilateral level, such adaptation was provided during the Earth Summit 1992, which presented the Rio Declaration, CBD and UNFCCC (Charles, 2012).

According to SDG 14 (and as shown in Figure 3), EPAs are the main governmental (governing) authorities for the protection of the marine environment. The EPAs shall be empowered to monitor and report the conditions of the marine environment (including fisheries, waste, sanitation, and climate) under SDG 14 (Zulfikar and Butt, 2021). The element of 'adaptation' provides that there shall be collaboration among and between the governing authorities for the overall protection of ecosystems generally and the marine environment specifically (Zhang et al., 2023b). The element of the 'precautionary approach' provides that in decision-making in the development or exploitation of resources, there shall be restraint when it can harm the marine environment. The element of 'precautionary approach', therefore, shall be exercised by the EPA for effective and long-sighted implementation (Zhang et al., 2023b).

Moreover, SDG 14 reiterates the basic phenomena of the Aarhus Convention and Rio Declaration for the 'participation' of the public at large through ENGOs and political actors (Gazley et al., 2010). The element of 'capacity building' in environmental decision-making and implementation processes allows various actors to protect their (environmental) interests through different governmental authorities. Similarly, the element of 'participation' allows various governing authorities to participate in each other's decision-making and implementation processes for the protection of their interests while keeping overall ecosystem preservation insight (Coenen, 2009). Through such processes, an amalgamation of all governmental authorities is created to protect the marine environment. The section below provides a detailed description of the existing ocean governance regimes of China and Pakistan. It also compares both ocean governance mechanisms to form an argument about what mechanisms should be adopted by both states in national and bilateral ocean governance through existing examples (for example, Canada and the USA).

3 Analysis of the ocean governance framework of China and Pakistan

In this section, the existing legal and governance framework and mechanisms of China and Pakistan are analyzed under the above-developed SDG 14 framework. It is already established through the methodology that SDG 14 is a legally binding set of elements,

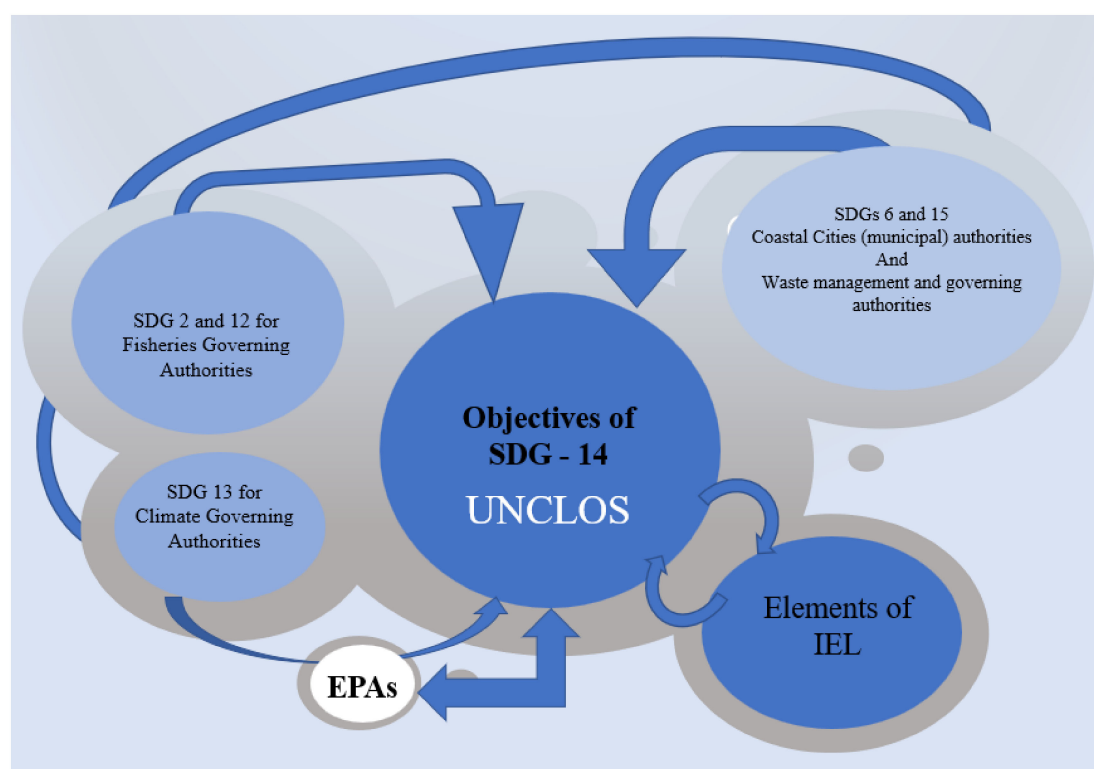


FIGURE 3

Elements of Ocean Governance under SDG 14, Connecting SDGs and Governing Authorities in Bilateralism. Source CRILL Methodology Results showing the interrelations and interconnectedness of elements, objectives and governing authorities of ocean governance under UNCLOS and IEL (refer to [Appendix](#) and Section 2.1 and 2.2).

objectives, and governance mechanisms for ocean governance under bilateral arrangements. Therefore, this analysis is conducted to find out the capacity of the existing institutions of China and Pakistan in ocean governance. The discussion below reflects how far both China and Pakistan have established their frameworks for ocean governance and their transformation for bilateral arrangements.

3.1 Analysis of China's ocean governance

The marine region of China encompasses temperate, subtropical, and tropical zones, offering abundant prospects for the local populace, industrialists, and government to harness marine resources (Zou, 2012). China's vast marine domain spanning 3 million km has provided it with a significant geographical advantage, enabling the development of critical businesses on a global scale (Zou, 2000). China, driven by its ambition to accelerate demographic growth and become a worldwide economic powerhouse, has inflicted substantial harm upon the natural environment (Zou, 2012). The detrimental effects of marine pollution, with over eighty per cent originating from land sources, have had a harmful impact on marine ecosystems, encompassing fisheries, marine life, and biodiversity (Sekovski et al., 2012). The primary and underlying cause of marine pollution is the expansion of urban coastal development, which

was promoted to accommodate China's increasing population (Bin et al., 2009). The coastal regions of China, characterized by residential zones and large commercial hubs, have been responsible for generating substantial amounts of waste and litter, resulting in significant harm to the marine ecosystem. Various contaminants, such as sewage, hydrocarbons, plastic, sediments, fertilizers, pesticides, and debris, were introduced into the oceans next to China, causing damage to marine ecosystems (Bin et al., 2009).

In 1979, China implemented the Environmental Protection Law (EPL) as a fundamental legal framework that addresses the environment under new EIA mechanisms ([Environmental Protection Law of the People's Republic of China Environmental Legislation in China, 2004](#)). China enacted the Marine Environmental Protection Law (MEPL) in 1982, the Law on Prevention and Control of Water Pollution (LPCWP) in 1984, and the Law on Prevention and Control of Atmospheric Pollution (LPCAP) for climate governance in 1987 (Butt et al., 2021a). Under the EPL, MEPL, LPCWP and LPCAP, a State Environmental Protection Administration (SEPA) was established to monitor and govern terrestrial and marine environments (Table 3) (Chen and Uitto, 2003). After that, China actively participated in the Earth Summit and established the Department of Climate Change (DCC) under the Ministry of Transportation (MOT) for the holistic implementation of climate governance mechanisms (Butt and Zulfiqar, 2023).

After ratifying the UN Fish Stocks Agreement and CITES, China established the Fisheries Administration Department (FAD) under the Ministry of Agriculture with the specific purpose of monitoring fisheries (Zhang and Wu, 2017). China enacted the Fisheries Law of 1986 to license fisheries companies and provide them with specific quotas for the sustainability of marine habitats and ocean ecosystems (Table 3) (Zhang and Wu, 2017). China established the State Oceanic Administration (SOA) for the governance of marine resources and holistic implementation of ocean governance ((Law of the People's Republic of China on Prevention and Control of Water Pollution 1996 (Amended 1996, into force 1984) (No 182/34)), n.d.). The mentioned legislations primarily address the conservation of the fisheries and protection of the maritime environment by regulating the discharge of pollutants originating from land and GHG emissions (as shown in Table 3 and Figure 4; also refer to Appendix) (Chang et al., 2020).

In 2018, China conducted significant ocean and environmental governance reforms, specifically for marine environmental protection (Chen et al., 2021). China realized that infrastructure and industrial development without strict EIA, weak administrative control over waste-and-sewerage management in the cities, fragile compliance of industrial-based discharge and inadequate legislation are fundamental reasons behind marine pollution, depleting fisheries and ocean acidification (Butt and Zulfiqar, 2023). Therefore, China established the Ministry of Environment and Ecology (MEE) for overall environmental governance and the Department of Marine Environment and Ecology (DMEE) for marine environmental protection. Moreover, China dissolved SOA and placed its functions under the Ministry of Natural Resources (MNR) for effective governance of marine resources and fisheries with the coordination of FAD (Bin et al., 2009).

Furthermore, China thoughtfully addressed ocean acidification and rising sea levels due to climate change. As China was already trying to control and mitigate GHG emissions, MEE recently established an emission trading scheme (Ren and Ji, 2021). MEE further developed National Climate Change Strategies (NCCS) to address the climate change issue and Marine Functional Zones and Coastal Provinces Plans (NPMFZCP) to address the acidification and rising sea levels (National Development and Reform Commission of China, 2016). DMEE developed further programs under the given mandate of MEPL and integrated the NCCS into marine environmental protection, including i) equitable preservation of MPAs, ii) strengthening coastal ecological restoration, and iii) monitoring of natural disasters to ensure early warning (Notice of the National Development and Reform Commission on Printing and Distributing the National Plan for Climate Change, 2014).

Through such comprehensive marine environmental protection (NPMFZCP) plans under the existing legislation, China has taken an ecosystem-based approach. As adopted by China, the process of ocean governance involves diverse authorities at various levels with one purpose, which is marine environmental protection. MEE and MNR allow various authorities, organizations and institutions to

TABLE 3 Marine Legislation in China.

Year	Law	Relevant IEL	Implementing Authority
Environmental Protection Legislation in China			
2015	Environmental Protection Law	CBD, Stockholm Declaration and Rio Declaration and update after SDGs	SEPA now MEE
1995	The Law on the Prevention and Control of Environmental Pollution		
1984	The Law on the Prevention and Control of Water Pollution		
2014	The Law on the Prevention and Control of Atmospheric Pollution	UNFCCC and update after SDGs	DCC under the MEE MOT
2002	EIA Regulations of 1970, to date 2002 Reporting and Monitoring under EPL		All the relevant departments
Marine Pollution Prevention Legislation in China			
1982	Marine Environment Protection Law of the People's Republic of China (revised on December 25, 1999), 1982	UNCLOS	DMEE under the MEE MOT
2017	Law of the People's Republic of China on Marine Environmental Protection (2017 Amendment)	Update after SDGs	
1990	Regulations on the Administration over the Prevention and Control of Land-based Pollutants from Polluting and Damaging the Marine Environment	UNCLOS	
Fisheries Legislation in China			
1986	Fisheries Law of the People's Republic of China (revised on October 31, 2000, and August 28, 2004)	UNCLOS	MNR, Ministry of Agriculture and FAD
1989	Regulations on Traffic Safety in Fishing Harbor Waters (revised on January 8 2011),	Ditto	
2003	Regulations of the People's Republic of China on Survey of Fishery Vessels and Port Law of the People's Republic of China	Fish Stocks Agreement	
2013	Regulations of the People's Republic of China on the Protection of Aquatic Wild Animals (2013 Amendment)	CITES	

Source Official Website for Legislation in China: <https://english.www.gov.cn/archive/lawsregulations>, A Comparative Analysis of the Environmental Policies in China and Pakistan: Developing a Legal Regime for Sustainable China-Pakistan Economic Corridor (CPEC) under the Belt and Road Initiative (BRI), IPRI J. 21 (2021) (also refer to Appendix).

ensure participation in decision-making processes (as shown in Figure 4) (Zhang et al., 2023a). MEE, DMEE and FAD monitor private and public stakeholders in developing fisheries, coastal areas and other economic activities which may impact the marine environment for implementing a precautionary approach (Butt and Zulfiqar, 2023). Participation and precautionary approach are provided under the EIA and Reporting and Monitoring Regulations under the EPL and MEPL (as mentioned in Table 3 and shown in Figure 4) (Butt and Zulfiqar, 2023; Zhang et al., 2023a).

As shown in Figure 4, China is in the process of implementing SDG-14 (under UNCLOS and IEL) in ocean governance across all marine environmental protection levels, including administrative factors, governance actors, departmental overlay and authoritative hierarchy. (Tianjie, 2021) DMEE (under MEE), FAD (under Ministry of Agriculture), MOT, and provincial governments work closely with MNR for marine environmental protection. DMEE under the MEE administers the enforcement duties in a unified manner, strengthening marine environmental pollution control and ensuring national ecological security (Chen et al., 2019; Chen and Qian, 2020). This position of MEE reflects that there has been significant consideration of the adaptation of various policies and participation of diverse authorities in ocean governance (Wang et al., 2018).

3.2 Analysis of Pakistan's ocean governance framework

With a coastline of about 1046 km, the marine region of Pakistan is quite small in area as compared to China (Ali, 2019).

The two main cities or administrative divisions with coastal areas, namely Gwadar and Karachi, are also the port cities of Pakistan. Although Pakistan has enough fishery resources that have not yet been developed, marine pollution from land-based sources already harms marine habitats (Butt et al., 2021a). Due to recent industrial and infrastructural development through the CPEC of BRI, there is a significant threat to the marine environment, habitat and ocean ecosystems (Dadwal and Purushothaman, 2017). Therefore, the Supreme Court of Pakistan urged the development of novel and effective marine environmental protection laws under global environmental imperatives (Shehla Zia v. W.A.P.D.A, n.d.).

In 1999, Pakistan's environmental law was structured under the Stockholm Declaration and the RIO Declaration and reserves a significant impact on Pakistan's ocean governance framework with the specific purpose of marine environmental protection (Maple Leaf Cement Factory Vs Environmental Protection Agency, n.d.). The Pakistan Environmental Protection Act (PEPA) is the primary law governing the environmental impacts of development and infrastructure projects (Punjab Environmental Protection Act, 1997 (XXXIV of 1997) Amended upto Act XXXV of 2012, enacted in 2012 (Government of Punjab, Pakistan), n.d.). The Environmental Protection Agency (EPA) is a central authority responsible for monitoring and regulating the provincial environmental authorities (PEAs) (Punjab Environmental Protection Act, 1997 (XXXIV of 1997) Amended upto Act XXXV of 2012, enacted in 2012 (Government of Punjab, Pakistan), n.d.). The PEAs are empowered to implement the EIA mechanisms at provincial and local levels under the provincial laws and regulations. The coastal provinces of Pakistan (Sindh and Baluchistan) have a general environmental law for ocean

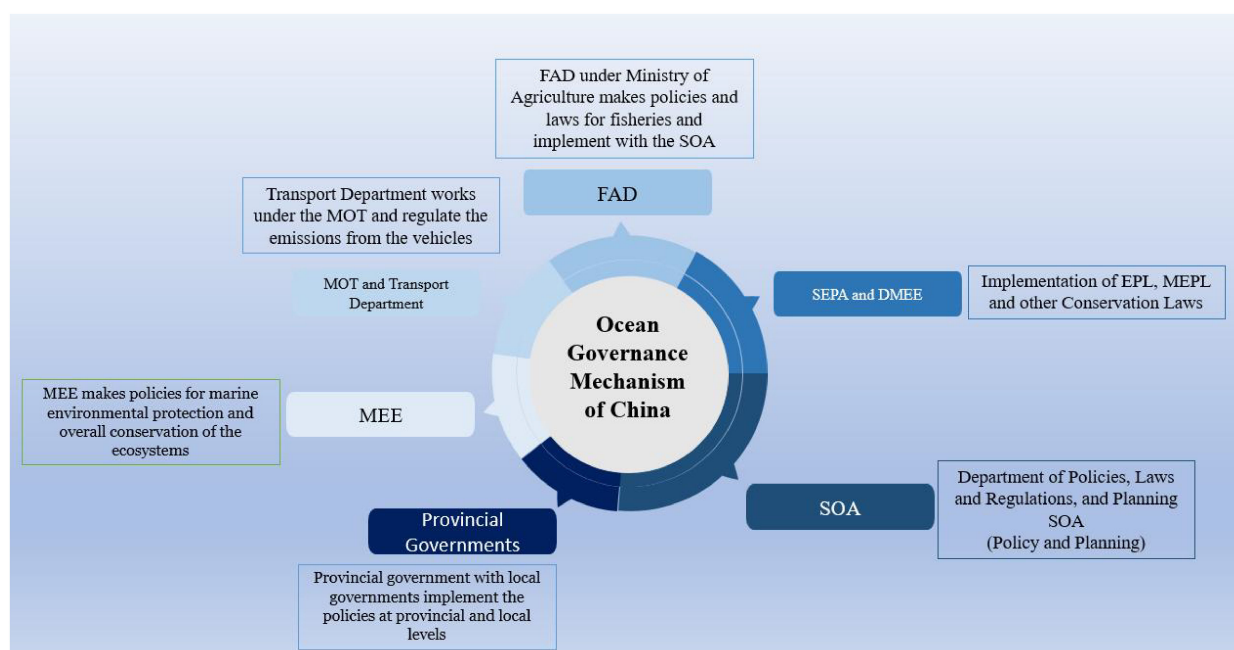


FIGURE 4

Ocean Governance Mechanism of China after 2018 Reforms and NPMFZCP. Source CRILL Methodology Results through Analysis under Section 2 (refer to Appendix).

governance and a fisheries board for licensing and monitoring. The authorities governing waste and sanitation in the cities are separate entities working under two tiers of the provincial government (Ali et al., 2013).

In 2017, the environmental law of Pakistan was restructured, and a Climate Change Authority (CCA) was established under the Pakistan Climate Change Act (PCCA), which works in coordination with the EPA (as shown in Table 4; also refer to Appendix) (Pakistan Climate Change Act 2017, No. F. 9(4)/2017-Legis, enacted 2017 (Government of Pakistan), n.d.). This step was taken considering the UNFCCC, the Kyoto Protocol and the Paris Agreement. The newly implemented PCCA addresses all kinds of environmental threats, including air, terrestrial and marine (Asad Abbas Maken, 2014). The primary concern of such restructuring of environmental authorities is droughts and floods faced by Pakistan due to climate change over the past 12–15 years (Pakistan Passes Climate Change Act, Reviving Hopes - and Skepticism, 2017). Furthermore, this restructuring also recognizes the mountains, rangelands, arid, coastal and wetlands ecosystems and their disruptions through energy, town, industrial and infrastructural development. This restructuring was meant to purview the environment holistically and engender more coordination among the provincial and federal governments. Therefore, the CCA directed the local transportation authorities and energy regulators (regulating coal power plants) to enact efficient frameworks for air pollution control (Butt et al., 2021a).

The lack of institutional coordination threatens Pakistan's marine environment and fisheries. To date, there is no specific legislation regulating marine environmental protection. The marine environment is governed under the general provisions of PEPA and provincial legislation (Figure 5). The provincial laws that apply to the coastal zones cover port development in protecting the marine environment, and such legislation necessitates monitoring under strict guidelines for the environmental degradation caused by the ports and shipping (The Baluchistan Environment Protection Act, 2012, (No. PAB/Legis: V (9)/2013), enacted 2013 (Government of Baluchistan), n.d.). However, the latest marine environmental threats (due to atmospheric pollution, waste and sanitation emerging from the terrestrial environments) are not convincingly covered under the

existing laws (Butt et al., 2021a). Therefore, the UNCLOS signed and ratified by Pakistan lacks effective implementation; neither is there any effort in sight to implement SDG 14 or other international commitments related to ocean governance. The fundamental governance problem in controlling marine pollution is overlapping jurisdiction between the three authorities, i.e., fisheries board, EPAs (provincial and federal), and local authorities (Figure 5).

Although the EPA, through PEPA and EIA, takes a precautionary approach in development and infrastructural projects, the weak coordination of provincial authorities, CCA, and local governments causes marine pollution and adverse impacts on fisheries (Butt et al., 2021a). Only EPA coordinates with provincial authorities, ensuring limited participation in decision-making processes (as shown in Figure 5). Weak coordination (as shown in Figure 5) reflects that elements of adaptation and participation are not significantly implemented as required under SDG 14 (under UNCLOS and IEL) in ocean governance (Butt et al., 2021a). The administrative levels governing the environment administer the enforcement duties in a fragmented manner, causing environmental pollution, ocean acidification, rise in sea levels, and depletion of fisheries (Butt et al., 2021a). Therefore, it results that Pakistan has ignored the institutional coordination in ocean governance as an innovative means established under SDG 14.

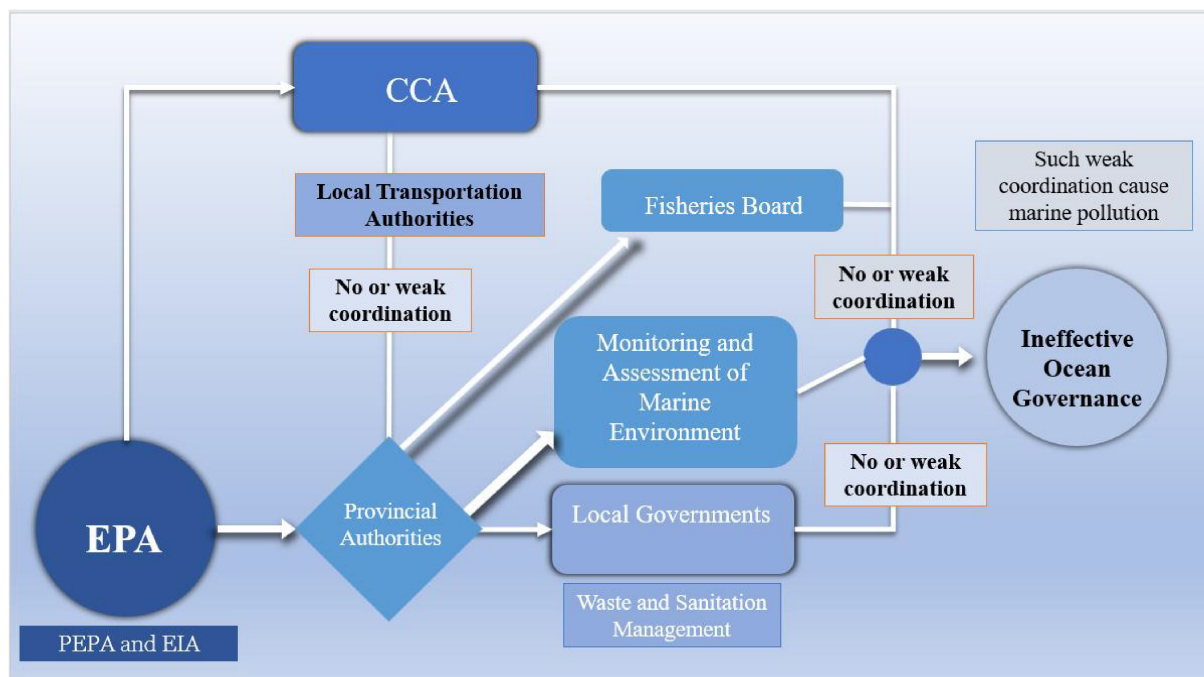
3.3 Comparison of ocean governance frameworks of China and Pakistan – institutional coordination for bilateralism

The governance and framework mechanisms under the laws of China are more advantageous than those in Pakistan. The ocean governance in Pakistan is disintegrated and fragmented among different authorities with complex or no coordination mechanisms. In terms of comparison, it can be observed that China is in an evolutionary process toward SDG 14 in ocean governance, and Pakistan does not have comprehensive laws or mechanisms governing oceans (Zhang et al., 2023a). In order to achieve

TABLE 4 National Legislation of Pakistan on Ocean Governance.

Law	Year Enacted	Purpose	Governing Authorities	Relevant IEL
PEPA	1997	Environmental Protection and Conservation, Climate Regulation, Marine Environmental Protection and Ecosystem Preservation	EPA	Environmental Declarations and CBD
Provincial Laws	2014		PEAs	
Sindh Environmental Protection Act Baluchistan Environmental Protection Act	2013			
Exclusive Fisheries Zone Act (Regulation of Fishing) Act	2015	Preservation of Marine Habitat	Fisheries Board	Fish Stock Agreement and CITES
PCCA	2017	Climate Change Control and Flood Prevention (ocean acidification and coastal flooding not specifically mentioned)	CCA	UNFCCC, Paris Agreement and Kyoto Protocol

Source A Comparative Analysis of the Environmental Policies in China and Pakistan: Developing a Legal Regime for Sustainable China-Pakistan Economic Corridor (CPEC) under the Belt and Road Initiative (BRI), IPRI J. 21 (2021) (also refer to Appendix).



bilateralism in ocean governance, Pakistan requires a comprehensive mechanism under existing laws (or through making new laws) for ocean governance with CBDG. [Table 5](#) illustrates the differences in laws and authorities from four aspects: environmental protection (from waste and sanitation), marine environmental protection, fisheries preservation, and climate change (causing ocean acidification and sea level rise) ([Butt et al., 2021a](#)).

It can be further observed through Table 5 that although there are more governing authorities in China, effective coordination and cooperation (as shown in Figure 4) enable them to provide positive outcomes. On the other hand, there are fewer authorities in Pakistan involved in ocean governance, albeit in ways that are ineffective due to the lack of an umbrella mechanism of ocean governance. Furthermore, the CCA of Pakistan, although collaborating with EPAs, does not consider ocean governance (acidification and sea-level rise) in its agenda (Butt and Zulfiqar, 2023; Zhang et al., 2023a). The purpose of the CCA (of Pakistan) is to be a coordinating organ, intending to coordinate with multiple authorities and governing actors to control atmospheric pollution effectively (Tables 4 and 5 and Figure 5) (Butt and Zulfiqar, 2023; Zhang et al., 2023a). Nevertheless, the functions of CCA are strictly limited; that is, the respective provincial departments governing fisheries are out of the loop. On the other hand, China's DCC integrates the ocean governing authorities (along with FAD) to implement climate change laws effectively (Butt and Zulfiqar, 2023; Zhang et al., 2023a).

In China, the FAD under the Ministry of Agriculture governs fishing activities and is responsible for conserving fish stocks (Butt and Zulfqar, 2023; Zhang et al., 2023a). The FAD comprises four secondary organs with the same name under the divisional/

provincial governments (the FADs of the Yellow Sea Area and Bohai Sea Area, the FAD of the East China Sea Area, and the FAD of the South China Sea Area) (as shown in [Tables 3](#) and [5](#), and [Figure 4](#)) ([Butt and Zulfqar, 2023](#); [Zhang et al., 2023a](#)). However, in Pakistan, the Fisheries Board does not significantly cooperate with the EPA and PEAs for the preservation of fisheries. The Fisheries Board regulates the licensing and fish stock under the purview of their law (known as the Exclusive Fisheries Zone Act), which is limited to fishing activities and does not govern the environmental pollution and climate change impacting fisheries ([Mu and Journal, n.d.](#)).

Given the above, the ratio compared between marine pollution in China and Pakistan demonstrates the current institutional overlaps (Qayum and Zhu, 2018). The problem identified so far is regarding the increasing marine pollution due to activities in Gwadar port as part of CPEC and the larger BRI. The existing marine pollution situation is already worse and will be further exacerbated due to CPEC development. Figure 6 shows the percentage of different forms of pollution impacting the oceans, drawing a comparison of Pakistan and China (Irfan et al., 2020). The figure in the form of a graph demonstrates the effectiveness of China in controlling marine pollution through institutional coordination and the practices of local integration.

The case study on which the figure is based was conducted in 2020 by the United Nations Environment Programme (UNEP) (Environment, U. N., 2023). This report, based on the case study of the lack of environmental institutional coordination in Pakistan, also argues that there is no informed decision-making process in Pakistan. The problem lies in the governance structure of Pakistan, and institutional reforms mean that there should be downside

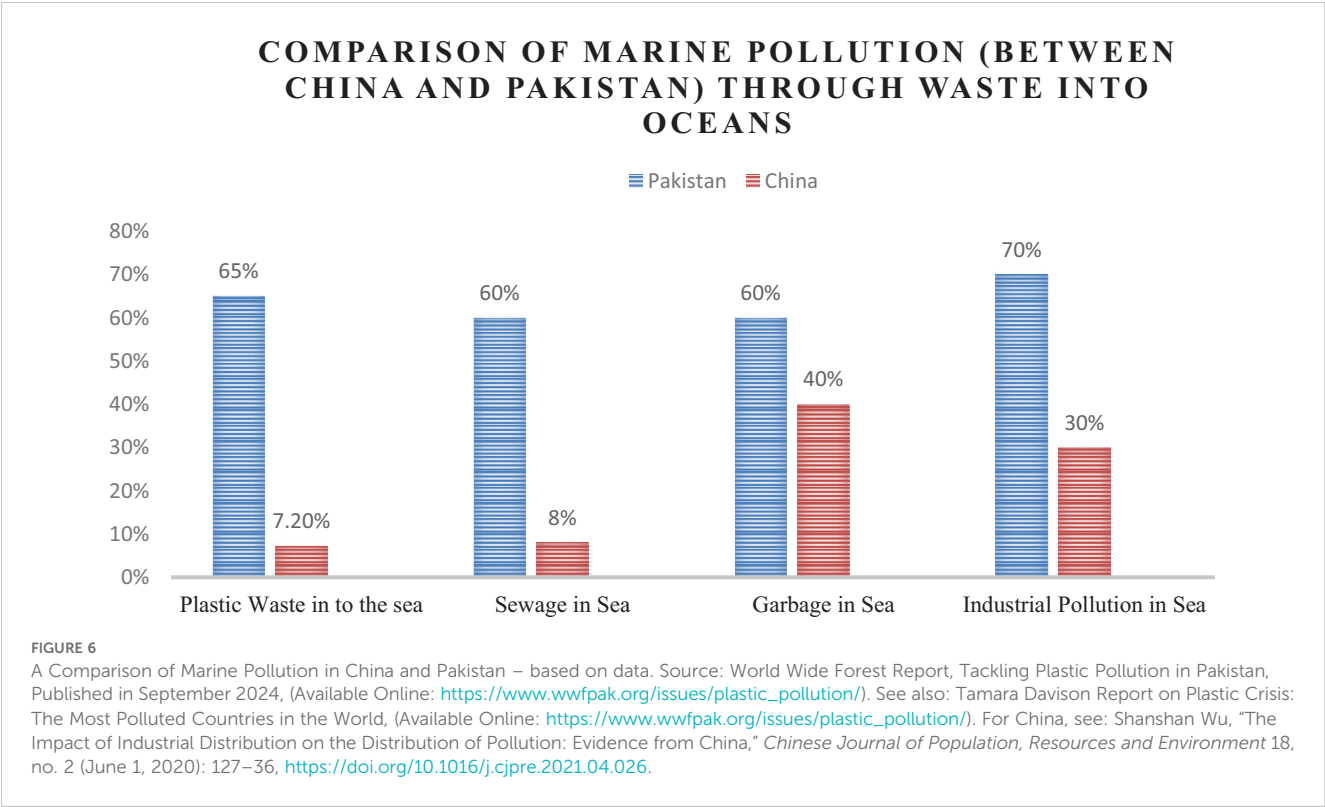
TABLE 5 Comparison of Marine Legislation and Ocean Governance Framework of China and Pakistan.

Divisions/Connections through Laws	Pakistan		China	
	Law	Governing Authorities	Law	Governing Authorities
Environmental Protection	PEPA	EPA PEAs	EPL LPCEP LPCWP	SEPA now MEE
Marine Environmental Protection	Provincial Laws None or the marine environmental provisions in the PEPA, Sindh Environmental Protection Act or Baluchistan Environmental Protection Act		MEPL Regulations on the Administration over the Prevention and Control of Land-based Pollutants from Polluting and Damaging the Marine Environment	DMEE under the MEE MOT
Fisheries	Exclusive Fisheries Zone Act (Regulation of Fishing) Act	Fisheries Board	Fisheries Law of the People's Republic of China and Regulations of the People's Republic of China on the Protection of Aquatic Wild Animals (2013 Amendment)	MNR, Ministry of Agriculture and FAD
Climate Change	PCCA	CCA	The Law on the Prevention and Control of Atmospheric Pollution	DCC under the MEE MOT

Source: Comparative Analysis under CRILL Methodology – Refer to Section 2 and [Appendix](#).

decentralization and upside centralization ([Husain, 2018](#)). Therefore, practical application as a consequence of the informed decision-making process requires integration of institutions at various levels.

The next section and its subsection suggest that Pakistan shall transform its institutional approach towards ocean governance through learning from China’s experience. The above comparative analysis already illustrates the reasons behind the weaknesses of the



ocean governance mechanisms of Pakistan. Lack of cooperation among institutions is one of the primary causes, and in this area, the work of China appears to be remarkable. Therefore, China's experience of ocean governance is rich and convincing to be adopted for the future of bilateralism in ocean governance.

4 Transforming Pakistan's institutional/authoritative approach: learning lessons from China under bilateral arrangements

The historical evolution of the various environmental, fisheries, and marine authorities in China indicates that it is a technical task to establish a comprehensive ocean governance framework. A coordinating central authority is a preliminary step with a plan or policy to work as a transitional scheme for the final reform of the disintegrated pattern to an integrated one. Therefore, it is imperative for Pakistan (while learning from China's reform) to have a step-by-step process to accomplish such a significant transformation in ocean governance. This section proposes that Pakistan can develop an ocean governance framework under SDG 14 through bilateralism (under CPEC of BRI) while learning from China's practice.

4.1 Sanitation and waste governance: local authorities capacity building and adaptation under bilateral arrangements as objective of SDG 14

Waste and sanitation causing water and urban pollution are primary reasons impacting the marine environment in Pakistan. In general, PEPA and local authorities have specific provisions for the mitigation of pollution occurring from sanitation and waste, but the capacity of local authorities is not fully developed in treating municipal wastewater and solid waste ([Pakistan Environmental Protection Act, 1997](#)). Therefore, large quantities of urban and industrial pollution are directly discharged into the oceans without much treatment ([Butt et al., 2021a](#)). Furthermore, residential and commercial development, mining, forest cutting, and land clearing add to the burden of marine pollution. Another problem in Pakistan is agricultural runoff, which is full of fertilizers and pesticides, and this finds its way to rivers and streams that run into the sea.

The CPEC is a comprehensive programme under the BRI that encompasses establishing connectivity between China and Pakistan's ports located in the Arabian Sea. The developments under CPEC indicate that there will be a significant increase in traffic, industrialization, and human activity at Pakistan's ports in the near future. Consequently, marine pollution will substantially increase, which will impact the whole ocean ecosystem (habitat and fisheries, also causing acidification and sea-level rise) ([Zulfiqar and Butt, 2021](#)). Although the Gwadar Port is significant for China's trade and strategic

concerns, the interest of China is extending to Port Qasim (located in Karachi City) and the Port of Karachi (also located in Karachi) to its Xinjiang province ([Baloch, 2016](#); [Khan, 2020](#)). The two ports of Karachi are strategically weak, and the development of Gwadar Port is imperative for both China and Pakistan (also) from a trading perspective (besides strategic objectives). Therefore, all three Pakistani ports are significant for international trade, strategy, and defense.

The CPEC has introduced a comprehensive plan for the development of a smart city in Gwadar ([Ashraf, 2017](#)). This plan encompasses the establishment of various facilities such as the Pak-China Friendship Hospital, a technical and vocational institute, the East-Bay Expressway (a highway), a free zone, and an airport ([Butt et al., 2021a](#)). The Gwadar Development Authority primarily oversees the urban development of the city in accordance with the Gwadar Development Authority Act ([Baloch, 2016](#); [Khan, 2020](#)). The Gwadar Development Authority recently revised the building laws to ensure effective building control, safety measures, and environmental monitoring ([Khan, 2020](#)). The Gwadar building regulations involve enforcing National Environmental Quality Standards (NEQS) Regulations and Local Environmental Quality Standards to mitigate air, water, and land pollution. The regulations also oversee the implementation of sanitation and solid waste management measures, including storm and rainwater drainage systems, with a particular focus on preserving existing forests ([Gwadar Building Regulations, 2020](#), Notification of the Gwadar Development Authority under Section. 24 of the Gwadar Development Authority Act, 2003, enacted 2020 (Local Government of Gwadar, Baluchistan, Pakistan), n.d.).

A reform process can be carried out step-by-step, as provided by SDG 14, with the elements of adaptation and participation ([Final list of proposed Sustainable Development Goal indicators, 2016](#)). It is essential for Pakistan to establish a comprehensive framework for the mitigation or proper disposal of waste and wastewater (through recycling and landfill systems). This requires capacity development and technological advancement in the current administration of Pakistan. Under the existing CPEC framework, Pakistan can develop and enforce such a cooperative mechanism with a mutual economic benefits system (bilateralism and cooperation). This can help build the administration's capacity and transfer the technology mechanisms for pollution mitigation.

4.2 Climate change and ocean governance mechanism for implementation of SDG 14 through participation, capacity building and precautionary approaches

Other than tree planting campaigns, Pakistan has formed a dedicated ministry for climate change, but no meaningful steps have been taken to reduce greenhouse gas emissions ([Ali et al., 2013](#)). The CCA does not have sufficient funding and monitoring procedures to ensure the implementation of the NEQS under the PCCA. Furthermore, shifting precipitation patterns and rising temperatures in many parts of Pakistan have significantly increased the frequency and severity of droughts and floods

(Ahsan and Khawaja, 2013). Floods, closely linked to the rise in sea levels, could worsen food and water insecurity in the context of global warming. In this scenario, Pakistan is still a long way behind in terms of capacity and legislative actions to mitigate ocean acidification and sea level rise.

As compared to China, the impact of climate change on oceans is not addressed in Pakistan as a matter of urgency. Although the major coastal cities of Pakistan are seriously threatened by coastal flooding, as informed by several ENGOs (UNFCCC, UNDP, and UNEP), the government of Pakistan and other provincial governments do not have any plan to mitigate rising sea levels (Fazil, 2014). Recently, the CCA created a National Action Plan prioritizing environmental issues, including terrestrial, atmospheric, and marine ecosystems. The Planning Commission of Pakistan generated a report for the incorporation of environmental objectives into development and infrastructure projects (Ullah et al., 2021). However, effective steps and implementation mechanisms under a series of legislation have not been conducted yet.

A reform process under SDG 14 guidelines for developing stringent climate change laws emphasizes participation, adaptation, and a precautionary approach (Final list of proposed Sustainable Development Goal indicators, 2016). It is critical for Pakistan to establish a comprehensive framework for climate change mitigation with the help of China under the CPEC framework. The CPEC development is already highly impacting climate change in Pakistan, and this becomes necessary under the IEL commitments that China shall assist Pakistan for capacity building and adaptation. Pakistan should reconsider the implementation mechanism of climate change with ocean development under CPEC. CCA shall focus on developing the capacity of the local administrations and provincial authorities to monitor, mitigate and control the atmospheric pollution. Additionally, the CCA can create and implement these kinds of cooperative mechanisms with EPAs and other pertinent authorities under the current CPEC framework, which can aid in enhancing the administration's ability and transferring technology to mitigate atmospheric pollution.

4.3 Fisheries preservation in Pakistan: a specific issue of ocean governance and climate change

The fisheries in Pakistan face various risks that have not been comprehensively addressed through legal measures. The threats from marine and atmospheric pollution (ocean acidification and rising sea levels) are evident (LLC and LLC, 2010). The capacity of the Fisheries Board to recognize and address the threats to fisheries is weak because of the inadequate implementation of existing laws and the lack of development of regulations in accordance with international agreements (related to fisheries) (Mu and Journal, n.d.) The independent workings of the Fisheries Board under the direct control of the provincial government are a classic example of

isolated governance in Pakistan. Such isolation also causes institutional overlapping and disintegration between the authorities.

There is a low-risk perception and inadequate recognition of the threats to fisheries under the CPEC development programmes (Kaczan and Patil, 2020). The reports of ENGOs suggest that legislative development and implementation can be used to mitigate risks to fisheries under the existing CPEC framework (Mohsin et al., 2017). Furthermore, China can assist Pakistan under the CPEC framework with SDG 14 for the sustainable development of fisheries. The Fisheries Board shall cooperate with other authorities (EPAs and PEAs) for the effective implementation of environmental and climate change laws for the preservation of fisheries.

It is also pertinent to highlight that the need for measures to revitalize the fisheries in Pakistan shall be based on a precautionary approach. This means that any framework related to fisheries, environment and climate or any development project, shall consider the preservation of fisheries. Recently, the development of the Gwadar port and Gwadar city projects has not considered the impact of such development on fisheries. For such purposes, representation of the local population (including fishermen), participation of relevant authorities, and adaptation of the implementation process are necessary to ensure the sustainable development of fisheries under the CPEC arrangement as provided under SDG 14 (Final list of proposed Sustainable Development Goal indicators, 2016).

5 The ocean governance regime of CPEC – bilateralism under international law and SDG 14

While conducting CRILL analysis, it was also observed that a bilateral ocean governance framework exists between Canada and the USA. Both States have a long history of cooperation in ocean governance affairs in the Northeast Pacific and the Northwest Atlantic (Rochette et al., 2015). Given this cooperation, both States have established a Joint Task Force (JTF) to ensure responsible conservation and sustainable use of marine resources for the mutual benefit of both nations and Indigenous populations (Barnes-Dabban et al., 2018). This is the classic example of bilateralism in ocean governance for China and Pakistan that can be adopted by both States effectively.

The vision of China is to develop oceans as the basis for enhancing the common welfare of humankind under the BRI. Bilateral ocean governance thematically supports the notion of 'blue economy' and 'ocean sustainability' (as per the aims and objectives of SDG 14) (Fang et al., 2021). The agenda of maritime cooperation under the BRI encourages States to align their policies for safe, secure, environmentally friendly transportation systems (Chen and Han, 2016). Through such sustainable objectives of China, Pakistan can build a blue partnership while pursuing a path of harmony between the oceans and infrastructure development under the concepts of 'blue economy' and 'green development' (Voyer et al., 2018) The CPEC under the BRI may also inculcate

environmental bilateralism and marine environmentalism in the BITs and FTAs (or develop a new bilateral framework for y, ocean governance).

The consideration of China in ocean governance frameworks globally is geopolitical and strategic. Although China has not ignored the environmental aspect of geopolitics, it has considered that shaping new governance mechanisms under BRI with larger environmental integration would be beneficial for developing states. Therefore, the existing framework of policies and legislation under the CPEC appears helpful in promoting the development of environmentally sustainable projects. However, the authorities responsible for implementing these regulations lack the specific capacity to preserve the marine environment adequately.

The primary issue identified in the CPEC development project is the lack of cohesive and organized coordination between environmental agencies (EPA and PEAs) and the local administration (Butt et al., 2021a). In addition, the authorities responsible for implementing the frameworks for ocean development have not coordinated with local authorities and administration. Currently, the development and management of ports are under the Ministry of Maritime Affairs and urban development and management are conducted by local governments. CCA for the implementation of climate change law also has weak coordination with the ocean governing authorities (Butt et al., 2021a).

It is vital for Pakistan to establish a comprehensive marine environmental authority and to distribute the implementation duties more efficiently and clearly. Such measures shall begin with a robust policy backed by research on the existing issues of disintegration and fragmentation among the authorities or other institutions (Chang, 2012). The duties and scope of various authorities shall be determined, and a holistic and integrated approach shall be adopted to implement marine environmental protection law effectively (Chang, 2012). Such a holistic approach can be observed through the means provided by the bilateralism in ocean governance mechanisms between Canada and the USA. An integration mechanism for marine environmental protection under new laws, as per the example of Canada and the USA, is substantial. Further suggestions based on that model are provided below:

- New legislation (namely 'Marine Environmental Protection Law' and as suggested in Table 6) comprehensively addressing the core marine environmental protection issues and designating a specific authority for marine environmental protection with functioning and mandate to coordinate and cooperate with EPAs, PEAs, Fisheries Board, local governments, Ministry of Maritime Affairs, CCA and central government. Such authorities for marine environmental protection already exist in China, Canada and the USA.
- Development of new legislation (namely 'Law for Marine Environmental Protection from Urban Waste, Sanitation, and Development' and as suggested in Table 6) that shall empower the local governments under the provincial government mechanisms with a capacity to control and

mitigate urban waste, sanitation and other waste generated through development, The legislation shall provide a mandate to local authorities to cooperate with marine environmental protection authority and CCA for reporting and monitoring measures related to marine, atmospheric and terrestrial pollution control. A specific legislation on marine environmental protection already exists in the states of Canada and the USA, through which there is a mechanism to address transboundary pollution.

- New legislation (namely 'Law for Prevention of Atmospheric Pollution for Marine Environmental Protection' or as suggested in Table 6) or amendment in the existing PCCA addressing the specific impact of atmospheric pollution and climate change on oceans and marine habitats. China has recently adopted a policy to address the issues of ocean acidification and sea level rise. Through this policy, China is further looking to expand in the field of marine environmental protection.
- A new and comprehensive legislation (namely 'Law on Preservation of Fisheries and Marine Habitat' and as suggested in Table 6) on protecting and preserving fisheries and empowering the fisheries board to cooperate and coordinate with other relevant authorities for such purposes. The fisheries legislation of China comprehensively deals with marine fisheries with a developed department and division; through this, Pakistan can significantly learn to develop legislation and a specific department dealing with fisheries.

Such a reform process should be carried out as previously discussed while keeping the element of participation in order to include the stakeholders, ENGOs, the public-at-large, and authorities/institutions in policy-making and implementation procedures (Chang, 2012). The reform of authorities under a coordinating body should be established to strengthen the element of adaptation through information sharing and reporting mechanisms (Chang, 2012). Through adopting such policies and laws, there shall be a precautionary approach in development that will assist the marine environmental protection authority and other relevant authorities in developing and maintaining effective ocean governance under CPEC (Chang, 2012).

The evolution of such a reform process (as a soft obligation) shall be carried out with a step-by-step approach to develop an effective mechanism for ocean governance under SDG 14 as follows (and as proposed in Figure 7):

- The given legislation shall be part of significant policy reforms, which should be reflected in the bilateral arrangements of CPEC. FTAs and BIT of CPEC shall include the legislation on ocean governance with capacity building, adaptation and precautionary approaches in bilateral ocean governance.
- Bilateral ocean governance with CPEC arrangements shall reflect the international initiatives, including SDG 14. China, as a leader in global ocean governance, shall assist developing states like Pakistan in legislation, policy and implementation mechanisms.

TABLE 6 Proposed mechanism of bilateral ocean governance under CPEC framework.

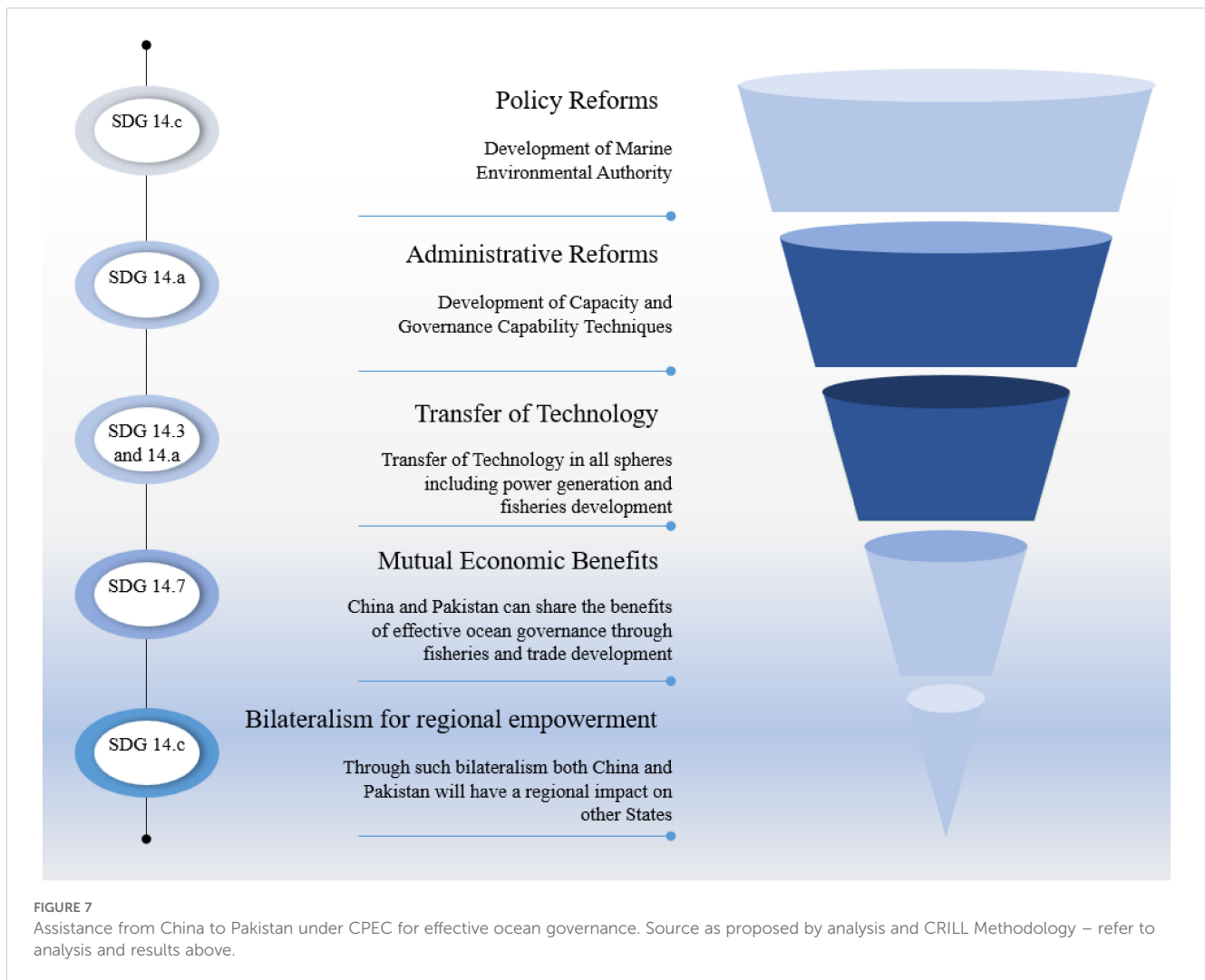
Projects under CPEC	Existing Marine Environmental Laws			Regulatory Laws	Implementation Authority	Required legislative development	Assistance Required from China through SDG – 14
	National Legislation	Provincial Legislation	Environmental Regulations				
Port Projects	PEPA PCCA	Provincial Legislation on Environmental Protection	EIA Regulations	Port Authority Regulations	Ministry of Maritime Affairs and Gwadar Port Authority	Marine Environmental Protection Law	Development of Marine Environmental Authority
Urban Development Projects (Gwadar Smart Port City Master Plan)				Local Laws and City Development Laws Building Regulations	Local Governments and City Government Authorities	Law for Marine Environmental Protection from Urban Waste, Sanitation, and Development	Development of appropriate waste and sanitation disposal capacity in the local governments
Infrastructure, Power Generation, and Transportation Projects				Miscellaneous	Various Authorities	Law for Prevention of Atmospheric Pollution for Marine Environmental Protection or Amendment in CCA	Climate-friendly power generation plants and the capacity to run them under technology transfer
Fisheries Development under CPEC (Proposed)	Exclusive Fisheries Zone Act (Regulation of Fishing) Act	None	None	Exclusive Fisheries Zone Act (Regulation of Fishing) Act	Fisheries Board	Law on Preservation of Fisheries and Marine Habitat	Enhance the capacity of the Fisheries Board and technology transfer

Source: Proposed suggestion of CRILL analysis.

- Policy Reforms under SDG-14 (c) for enhancing the conservation of marine habitat and sustainable use of oceans by implementing UNCLOS and IEL effectively ([Final list of proposed Sustainable Development Goal indicators, 2016](#)).
- Administrative under SDG-14 (a) through increasing scientific knowledge, developing research capacity and transfer of marine technology with the guidelines of the Intergovernmental Oceanographic Commission (IOC) ([Final list of proposed Sustainable Development Goal indicators, 2016](#)).
- Transfer of Technology under SDG – 14.3 and 14(a), and an enhanced scientific cooperation at regional and sub-regional (under bilateral agreements) levels ([Final list of proposed Sustainable Development Goal indicators, 2016](#)).
- Mutual economic benefits under SDG 14.7 through sustainable use of marine resources (including fisheries) ([Final list of proposed Sustainable Development Goal indicators, 2016](#)).
- Effective implementation of UNCLOS and IEL under SDG-14 (c) will provide a pertinent position to both China and Pakistan to have a global voice in international ocean governance ([Final list of proposed Sustainable Development Goal indicators, 2016](#); Zhang et al., 2023a).

Based on the above analysis, the structure and functions of relevant authorities in Pakistan shall evolve under a new ocean governance mechanism with assistance from China. As China has already developed such mechanisms and technology for sustainable fisheries, marine environmental protection, and climate change control (that mitigate impacts of atmospheric pollution causing ocean acidification and sea-level rise), Pakistan can seek assistance from China under SDG 14 and bilateral arrangements for the purposes provided below:

1. Development of a Marine Environmental Authority with the capacity to address marine pollution control that shall have the ability to coordinate and cooperate with various authorities with the specific purpose of marine environmental protection,
2. Development of appropriate waste and sanitation disposal capacity in the local governments of the coastal cities (where China's interests exist), and through learning disposal and management techniques and transfer of technology, Pakistan can develop further arrangements in other cities,
3. Climate-friendly power generation technologies in all fields and capacity to run them under technology transfer schemes, including climate-friendly transport, power generation plants and industries,



4. Enhance the Fisheries Board's capacity and technology transfer to develop mechanisms for preserving and sustainable developing fisheries.

A legal cooperation mechanism suggested by SDG 14 states that marine pollution of all kinds from land-based activities, including marine debris, nutrient pollution, and atmospheric pollution (causing ocean acidification and sea level rise), shall be addressed through enhanced scientific cooperation at all levels (Butt and Zulfiqar, 2023; Zhang et al., 2023a). These levels under SDG-14 are regional, sub-regional and could be bilateral. SDG-14 also presents the idea of increasing (and transferring) scientific knowledge, developing (and sharing) research capacity and transferring marine technology under the guidelines of the IOC Criteria to improve ocean sustainability and preservation of marine biodiversity (Butt and Zulfiqar, 2023; Zhang et al., 2023a). Such transfer and sharing of capacity, science and technology has to be from the developed States to developing States, small island developing States and least developed States (Butt and Zulfiqar, 2023; Zhang et al., 2023a). Therefore, China has a soft obligation to assist Pakistan on issues related to ocean governance.

6 Conclusion

This research paper analyzed the ocean governance frameworks of China and Pakistan and compared both by utilizing the CRILL methodology. The CRILL methodology can be helpful in analyzing the law and policy frameworks of various states in bilateral arrangements of governance mechanisms. The novel approach taken in this paper is to suggest a bilateral ocean governance framework through the CRILL methodology. This paper suggested that a new policy framework will formulate an integrated mechanism of ocean governance in Pakistan in terms of marine legislation, authoritative approach, and administrative reforms. Through CPEC of BRI (as of China's interests), Pakistan can seek assistance from China with a comprehensive focus on the implementation of SDG 14, and a new marine environmental authority shall be developed comprehensively addressing the pollution, preservation, conservation, and protection of ocean ecosystems (including marine habitat, fisheries, and other related ecological systems).

This research paper is a recommendation to the policymakers involved in developing and enhancing BRI and CPEC. Through this

paper, the policymakers shall have an idea about bilateralism in governance mechanisms for effective results. Moreover, policymakers and administrators in ocean governance shall also observe effective ocean governance mechanisms in this paper. Through this paper, future suggested research is about the preservation and protection of marine resources, effective law enforcement controlling IUU fishing (as per reports of IUCN) and mitigation and control of ship sources of marine pollution.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

SZ: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Software, Supervision, Writing – original draft, Writing – review & editing. QW: Writing – original draft, Writing – review & editing. MB: Formal analysis, Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing. MB: Formal analysis, Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing. MM: Formal analysis, Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The author(s) declare that no Generative AI was used in the creation of this manuscript.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmars.2025.1577975/full#supplementary-material>

References

- Ahmed, T., Scholz, M., Al-Faraj, F., and Niaz, W. (2016). Water-related impacts of climate change on agriculture and subsequently on public health: A review for generalists with particular reference to Pakistan. *Int. J. Environ. Res. Public Health* 13, 1051. doi: 10.3390/ijerph13111051
- Ahsan, I., and Khawaja, S. A. (2013). *Development of Environmental Laws and Jurisprudence in Pakistan*. (Islamabad, Pakistan: Asian Development Bank). Available at: <https://www.adb.org/sites/default/files/publication/31140/environmental-law-jurisprudence-Pakistan.pdf> (Accessed December 12, 2025).
- Ali, G. (2019). China–Pakistan maritime cooperation in the Indian ocean. *Issues Stud.* 5. doi: 10.1142/S1013251119400058
- Ali, S. S., Karim, N., Munshi, A. B., Siddiqui, I., and Khan, F. A. (2013). Health hazards among coastal villagers of Pakistan due to arsenic contaminated drinking water. *J. Water Resour. Prot.* 2013. doi: 10.4236/jwarp.2013.512132
- Asad Abbas Maken (2014). *Why Pakistan Needs a Climate Change Financing Framework?* (Islamabad, Pakistan: United Nations Development Programme, Pakistan). Available at: <https://www.adaptation-undp.org/explore/Pakistan> (Accessed December 22, 2024).
- Ashraf, S. (2017). Gwadar Will be the Economic Funnel for the Region, Op-Ed, Page - 24. *Gulf News*. Available at: <https://gulfnews.com/opinion/op-eds/gwadar-will-be-the-economic-funnel-for-the-region-1.2032494> (Accessed February 3, 2025).
- (1995). *Agreement for the implementation of the provisions of the united nations convention on the law of the sea of 10 december 1982 relating to the conservation and management of straddling fish stocks and highly migratory fish stocks*.
- (1998). Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (came into force 30 October 2001), (2161 UNTS 447).
- (1973). Declaration of the United Nations Conference on the Human Environment (U.N. Doc. A/Conf.48/14/Rev. 1).
- (2004). *Environmental protection law of the people’s republic of China environmental legislation in China* Vol. 37 (China: Chin. Law Gov), 58–65.
- (2016). *Final list of proposed Sustainable Development Goal indicators*. Available online at: <https://sustainabledevelopment.un.org/content/documents/11803Official-List-of-Proposed-SDG-Indicators.pdf> (Accessed January 2, 2025).

- (1997). Kyoto Protocol to the United Nations Framework Convention on Climate Change (came into force on 16 February 2005), (UN Doc FCCC/CP/1997/7/Add.1, Dec. 10, 1997).
- (2014). Notice of the National Development and Reform Commission on Printing and Distributing the National Plan for Climate Change, No. 2347, National Plans for Addressing Climate Change, Development Climate Change (2014–2020) (Pakistan: Ministry of Climate Change, Pakistan).
- (2017). Pakistan passes climate change act, reviving hopes - and skepticism. *Reuters*. Available at: <https://www.reuters.com/article/us-pakistan-climatechange-lawmaking-idUSKBN16V19N> (Accessed November 13, 2024).
- (1992). United Nations Conference on Environment and Development/Rio Declaration on Environment and Development (UN Doc. A/CONF.151/26) (vol. I).
- (1992). United Nations Framework Convention on Climate Change (came into force 21 March 1994), (1771 UNTS 107).
- Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973 (Enforced 1975) (993 UNTS 243).
- Law of the People's Republic of China on Prevention and Control of Water Pollution 1996 (Amended 1996, into force 1984) (No 182/34)*.
- Maple Leaf Cement Factory Vs Environmental Protection Agency, Lahore High Court, 2018, 255.
- Pakistan climate change act 2017, no. F. 9(4)/2017-legis, enacted 2017 (Government of Pakistan)*.
- Punjab Environmental Protection Act 1997 (XXXIV of 1997) Amended upto Act XXXV of 2012, enacted in 2012 (Government of Punjab, Pakistan)*.
- The Baluchistan environment protection act 2012, (No. PAB/legis: V (9)/2013), enacted 2013 (Government of Baluchistan)*.
- Baird, R., Simons, M., and Stephens, T. (2009). Ocean acidification: A litmus test for international law. *Carbon Clim. Law Rev.* 3, 459–471. Available at: <https://www.jstor.org/stable/24323666> (Accessed December 3, 2024).
- Baloch, K. (2016). In Pakistan, major Chinese investment plan hits more snags. *Gandhara* 24.
- Barnes-Dabban, H., van Koppen, C. S. A., and van Tatenhove, J. P. M. (2018). Regional convergence in environmental policy arrangements: A transformation towards regional environmental governance for West and Central African ports? *Ocean Coast. Manage.* 163, 151–161. doi: 10.1016/j.ocecoaman.2018.06.013
- Bin, C., Hao, H., Weiwei, Y., Senlin, W., Jinkeng, W., and Jinlong, J. (2009). Marine biodiversity conservation based on integrated coastal zone management (ICZM)—A case study in Quanzhou Bay, Fujian, China. *Ocean Coast. Manage.* 52, 612–619. doi: 10.1016/j.ocecoaman.2009.10.006
- Butt, M. J. (2021). The role of the international law in shaping the governance for sustainable development goals. *J. Law Polit. Sci.* 28, 87–164.
- Butt, M. J., Chang, Y. C., and Zulfiqar, K. (2021a). A comparative analysis of the environmental policies in China and Pakistan: developing a legal regime for sustainable China-Pakistan economic corridor (CPEC) under the belt and road initiative (BRI). *IPRI J.* 21, 83–122. doi: 10.131945/iprij.210104
- Butt, M. J., Chang, Y.-C., and Zulfiqar, K. (2021b). “Applicability of international law in development of sustainable port policy: an analysis of good practices and future policy of gwadar port,” in *International Association of Maritime Universities (IAMU) Conference*, Alexandria, Egypt (A Publication of International Association of Maritime Universities). Available at: https://www.researchgate.net/publication/355718582_Applicability_of_International_Law_in_Development_of_Sustainable_Port_Policy_An_Analysis_of_Good_Practices_and_Future_Policy_of_Gwadar_Port (Accessed November 21, 2024).
- Butt, M. J., and Zulfiqar, K. (2023). “Chapter 6. The role of China in global ocean governance: A marine environmental perspective,” in *Maritime Law Perspectives Old and New*. Eds. P. K. Mukherjee, J. Xu and M. Q. Mejia Jr. (Nova Science Publishers, United States of America). doi: 10.52305/DLMC5627
- Butt, M. J., Zulfiqar, K., and Chang, Y.-C. (2021c). The belt and road initiative and the law of the sea, edited by keyuan zou. *Int. J. Mar. Coast. Law* 1, 1–4. doi: 10.1163/15718085-BJA10051
- Cetin, M. (2020). Climate comfort depending on different altitudes and land use in the urban areas in Kahramanmaraş City. *Air Qual. Atmosphere Health* 13, 991–999. doi: 10.1007/s11869-020-00858-y
- Chang, Y.-C. (2012). A note on a comparison of the ocean governance system between mainland China and Taiwan. *Ocean Dev. Int. Law* 43, 311–329. doi: 10.1080/00908320.2012.698930
- Chang, Y.-C., Wang, C., Khan, M. I., and Wang, N. (2020). Legal practices and challenges in addressing climate change and its impact on the oceans—A Chinese perspective. *Mar. Policy* 111, 103355. doi: 10.1016/j.marpol.2018.11.018
- Charles, A. (2012). People, oceans and scale: governance, livelihoods and climate change adaptation in marine social-ecological systems. *Curr. Opin. Environ. Sustain.* 4, 351–357. doi: 10.1016/j.cosust.2012.05.011
- Chen, M., and Han, L. (2016). Driving factors, areas of cooperation and mechanisms for international cooperation in the blue economy of the 21st-century maritime silk road. *Strateg. Study Chin. Acad. Eng.* 18, 98–104. doi: 10.15302/J-SSCAE-2016.02.012
- Chen, X., and Qian, W. (2020). Effect of marine environmental regulation on the industrial structure adjustment of manufacturing industry: An empirical analysis of China's eleven coastal provinces. *Mar. Policy* 113, 103797. doi: 10.1016/j.marpol.2019.103797
- Chen, S., and Uitto, J. I. (2003). Governing marine and coastal environment in China: building local government capacity through international cooperation. *China Environ. Ser.*, 67–80. Available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.519.2635&rep=rep1&type=pdf> (Accessed December 12, 2024).
- Chen, B., Wang, M., Duan, M., Ma, X., Hong, J., Xie, F., et al. (2019). In search of key: Protecting human health and the ecosystem from water pollution in China. *J. Clean. Prod.* 228, 101–111. doi: 10.1016/j.jclepro.2019.04.228
- Chen, Q., Yu, H., and Wang, Y. (2021). Research on modern marine environmental governance in China: subject identification, structural characteristics, and operational mechanisms. *Int. J. Environ. Res. Public Health* 18, 4485. doi: 10.3390/ijerph18094485
- Coenen, F. (2009). “Local agenda 21: ‘Meaningful and effective ‘Participation?’,” in *Public Participation and Better Environmental Decisions: The Promise and Limits of Participatory Processes for the Quality of Environmentally Related Decision-making*. Ed. F. H. J. M. Coenen (Springer Netherlands, Dordrecht), 165–182. doi: 10.1007/978-1-4020-9325-8_10
- Convention on Biological Diversity (came into force on 29 December 1993), (1760 UNTS 79) (1992).
- Cormier, R., and Elliott, M. (2017). SMART marine goals, targets and management – Is SDG 14 operational or aspirational, is ‘Life Below Water’ sinking or swimming? *Mar. Pollut. Bull.* 123, 28–33. doi: 10.1016/j.marpolbul.2017.07.060
- Dadwal, S. R., and Purushothaman, C. (2017). CPEC in Pakistan's quest for energy security. *Strateg. Anal.* 41, 515–524. doi: 10.1080/09700161.2017.1343270
- Environment, U. N. (2023). *Pakistan | UNEP - UN environment programme* (Islamabad, Pakistan: United Nations Environment Programme and Ministry of Climate Change and Environmental Coordination Pakistan). Available at: <https://www.unep.org/explore-topics/chemicals-waste/what-we-do/special-programme/special-programme-projects-database-34>.
- Fang, X., Zou, J., Wu, Y., Zhang, Y., Zhao, Y., and Zhang, H. (2021). Evaluation of the sustainable development of an island “Blue Economy”: A case study of Hainan, China. *Sustain. Cities Soc.* 66, 102662. doi: 10.1016/j.scs.2020.102662
- Fazil, A. (2014). *Environment and water issues in Pakistan* (Lahore, Pakistan: Lahore High Court Research Center). doi: 10.2131/ssrn.2395669
- Gazley, B., Chang, W. K., and Bingham, L. B. (2010). Board diversity, stakeholder representation, and collaborative performance in community mediation centers. *Public Adm. Rev.* 70, 610–620. doi: 10.1111/j.1540-6210.2010.02182.x
- Gland (2016). Mainstreaming environment in the China-Pakistan Economic Corridor is must to protect fragile environment of Pakistan. *Int. Union Conserv. Nat.* Available at: <https://www.iucn.org/news/Pakistan/201612/mainstreaming-environment-China-Pakistan-economic-corridor-must-protect-fragile-environment-Pakistan> (Accessed November 13, 2024).
- Gulseven, O. (2020). Measuring achievements towards SDG 14, life below water, in the United Arab Emirates. *Mar. Policy.*, 103972. doi: 10.1016/j.marpol.2020.103972
- Gwadar Building Regulations (2020). *Notification of the Gwadar Development Authority under Section. 24 of the Gwadar Development Authority Act 2003, enacted 2020* (Baluchistan, Pakistan: Local Government of Gwadar).
- Haward, M., and Haas, B. (2021). The need for social considerations in SDG 14. *Front. Mar. Sci.* 8. Available at: <https://www.frontiersin.org/article/10.3389/fmars.2021.632282> (Accessed November 10, 2024).
- Husain, I. (2018). *Governing the ungovernable: institutional reforms for democratic governance* (Karachi: Oxford University Press).
- Irfan, T., Khalid, S., Taneez, M., and Hashmi, M. Z. (2020). Plastic driven pollution in Pakistan: the first evidence of environmental exposure to microplastic in sediments and water of Rawal Lake. *Environ. Sci. Pollut. Res.* doi: 10.1007/s11356-020-07833-1
- Kaczan, D. J., and Patil, P. G. (2020). Potential development contribution of fisheries reform: evidence from Pakistan. *J. Environ. Dev.* 29, 275–305. doi: 10.1177/1070496520925878
- Khan, S. (2020). Builders concerned over Gwadar Development Authority's new town planning regulations. *Samaa TV*. Available at: <https://www.samaa.tv/news/Pakistan/2020/02/builders-concerned-over-gwadar-development-authority-s-new-town-planning-regulations/> (Accessed October 12, 2024).
- Kucukpehlivan, T., Cetin, M., Aksoy, T., Senyel Kurkcuoglu, M. A., Cabuk, S. N., Isik Pekkan, O., et al. (2023). Determination of the impacts of urban-planning of the urban land area using GIS hotspot analysis. *Comput. Electron. Agric.* 210, 107935. doi: 10.1016/j.compag.2023.107935
- LLC, B., and LLC, G. B. (2010). *Ports and Harbours of Pakistan: Port Qasim, Gwadar Port, Gadani Ship-Breaking Yard, Minnagara, Barbarikon, Orana, Karachi Fish Harbor* (Karachi, Pakistan: General Books LLC).
- Mao, Z., Xue, X., Tian, H., and Michael, A. U. (2019). How will China realize SDG 14 by 2030?—A case study of an institutional approach to achieve proper control of coastal water pollution. *J. Environ. Manage.* 230, 53–62. doi: 10.1016/j.jenvman.2018.09.028
- Mohsin, M., Mu, Y., Memon, A. M., Mehak, A., Shah, S. B. H., Kalhor, M. T., et al. (2017). *Capture fisheries production and its economic role in Pakistan*. Available online at: <https://nopr.niscpr.res.in/handle/123456789/42015> (Accessed December 10, 2023).

- Mu, Y., and Journal, C. A preliminary study on fisheries economy of Pakistan: plan of actions for fisheries management in Pakistan. Available online at: https://www.academia.edu/12854869/A_Preliminary_Study_on_Fisheries_Economy_of_Pakistan_Plan_of_Actions_for_Fisheries_Management_in_Pakistan (Accessed January 18, 2022).
- National Development and Reform Commission of China (2016). *China's policies and actions for addressing climate change*. Available online at: <http://qhs.ndrc.gov.cn/zcfg/201611/W020161108342237594465.pdf> (Accessed December 13, 2021).
- Pakistan Environmental Protection Act (1997).
- Paris Agreement (adopted 12 December 2015, entered into force 4 November 2016), (C.N.63.2016.TREATIESXXVII.7.d).
- Proelss, A. (2019). "The contribution of the ITLOS to strengthening the regime for the protection of the marine environment," in *Interpretations of the United Nations Convention on the Law of the Sea by International Courts and Tribunals*. Eds. A.D. Vecchio and R. Virzo (Springer International Publishing, Cham), 93–106. doi: 10.1007/978-3-030-10773-4_6
- Qayum, S., and Zhu, W. (2018). Ship breaking industry of Pakistan and its environmental effect on marine life and humans. *IJMS* 4707. Available at: <http://nopr.niscair.res.in/handle/123456789/44621> (Accessed February 3, 2025).
- Ren, W., and Ji, J. (2021). How do environmental regulation and technological innovation affect the sustainable development of marine economy: New evidence from China's coastal provinces and cities. *Mar. Policy* 128, 104468. doi: 10.1016/j.marpol.2021.104468
- Rochette, J., Billé, R., Molenaar, E. J., Drankier, P., and Chabason, L. (2015). Regional oceans governance mechanisms: A review. *Mar. Policy* 60, 9–19. doi: 10.1016/j.marpol.2015.05.012
- Sekovski, I., Newton, A., and Dennison, W. C. (2012). Megacities in the coastal zone: Using a driver-pressure-state-impact-response framework to address complex environmental problems. *Estuar. Coast. Shelf Sci.* 96, 48–59. doi: 10.1016/j.jecss.2011.07.011
- Shehla Zia v. W.A.P.D.A, Supreme Court of Pakistan, All Pakistan Law Decisions, 1994, 693.
- Tianjie, M. (2021). Stockholm 1972: The start of China's environmental journey. *China Dialogue*. Available at: <https://chinadialogue.net/en/nature/stockholm-1972-Chinas-environmental-journey/> (Accessed October 11, 2024).
- Ullah, Z., Wu, W., Wang, X. H., Pavase, T. R., Hussain Shah, S. B., and Pervez, R. (2021). Implementation of a marine spatial planning approach in Pakistan: An analysis of the benefits of an integrated approach to coastal and marine management. *Ocean Coast. Manage.* 205, 105545. doi: 10.1016/j.ocecoaman.2021.105545
- Voyer, M., Schofield, C., Azmi, K., Warner, R., McIlgorm, A., and Quirk, G. (2018). Maritime security and the Blue Economy: intersections and interdependencies in the Indian Ocean. *J. Indian Ocean Reg.* 14, 28–48. doi: 10.1080/19480881.2018.1418155
- Wang, C. N. (2023). "Countries of the belt and road initiative (BRI)," in *Green finance dev. Cent. - anhai int. Sch. Finance FISF fudan univ. Shanghai China*. Available at: <https://greenfdc.org/countries-of-the-belt-and-road-initiative-bri/>.
- Wang, M., Tong, Y., Chen, C., Liu, X., Lu, Y., Zhang, W., et al. (2018). Ecological risk assessment to marine organisms induced by heavy metals in China's coastal waters. *Mar. Pollut. Bull.* 126, 349–356. doi: 10.1016/j.marpolbul.2017.11.019
- Zeren Cetin, I., Varol, T., Ozel, H. B., and Sevik, H. (2023). The effects of climate on land use/cover: a case study in Turkey by using remote sensing data. *Environ. Sci. Pollut. Res.* 30, 5688–5699. doi: 10.1007/s11356-022-22566-z
- Zhang, S., Butt, M. J., Iqatish, A., and Zulfiqar, K. (2023a). China's belt and road initiative (BRI) under the vision of maritime community with a shared future and its impacts on global fisheries governance. *Heliyon*. doi: 10.1016/j.heliyon.2023.e15398
- Zhang, S., Butt, M. J., and Zulfiqar, K. (2023b). Interconnected principles of ocean governance through science-policy integration under the judgements of the international dispute settlement bodies. *Sci. Prog.* 106, 368504231205395. doi: 10.1177/00368504231205395
- Zhang, H., and Wu, F. (2017). China's marine fishery and global ocean governance. *Glob. Policy* 8, 216–226. doi: 10.1111/1758-5899.12419
- Zou, K. (2000). Maritime legislation of Mainland China and Taiwan: Developments, comparison, implications, and potential challenges for the United States. *Ocean Dev. Int. Law* 31, 303–345. doi: 10.1080/00908320051058135
- Zou, K. (2012). China's ocean policymaking: practice and lessons. *Coast. Manage.* 40, 145–160. doi: 10.1080/08920753.2012.652514
- Zulfiqar, K., and Butt, M. J. (2021). Preserving community's environmental interests in a meta-ocean governance framework towards sustainable development goal 14: A mechanism of promoting coordination between institutions responsible for curbing marine pollution. *Sustainability* 13, 9983. doi: 10.3390/su13179983