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Campaign-style vs. collaborative governance: explaining coastal pollution policy implementation in China's Bohai Sea and Japan's Seto Inland Sea

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Marine pollution governance in semi-enclosed seas represents a significant global environmental challenge. Both China's Bohai Sea and Japan's Seto Inland Sea have achieved remarkable governance successes through sustained efforts in the face of similar ecological crises. However, their paths to these achievements diverge considerably. This study aims to investigate the differences in governance mechanisms that explain this phenomenon of "converging on the same destination via different routes." Using the Most Similar Systems Design and reconstructing the classic Sabatier-Mazmanian policy implementation model, this study conducts an in-depth, multi-variable comparative analysis of these two cases, focusing on their political-economic contexts, policy designs, and implementation arenas. The findings reveal that the success in the Bohai Sea exemplifies a campaign-style mobilization model, relying on top-down political authority for resource integration and goal-driven execution, demonstrating robust short-term problem-solving capabilities. In contrast, the success in the Seto Inland Sea stems from an institutionalized collaborative model, operationalized through a dedicated legal framework that creates a multifaceted, scientifically driven, and adaptive networked governance system—ensuring long-term governance resilience and sustainability. This study deepens the applicability of policy implementation theory across diverse institutional contexts and offers insights for exploring hybrid governance pathways that integrate the strengths of both models, thereby advancing sustainable management of global marine ecosystems.

KEYWORDS

marine environmental governance, coastal pollution control, policy implementation, campaign-style governance, collaborative governance

1 Introduction

Effective marine environmental governance is fundamental to global ecological security and sustainable development; however, its implementation remains a persistent global public administration challenge (United Nations, 2021; Leal Filho et al., 2025). This challenge is particularly severe in semi-enclosed seas. As critical junctions characterized by dense populations, concentrated economic activities, and fragile ecosystems, these seas epitomize the intense tensions between regional economic growth and ecological carrying capacity (Nixon, 1995). They are highly vulnerable to severe pollution originating from land-based activities (Kennish, 2002; Fletcher et al., 2024), making them crucial “touchstones” for national environmental policies. In this context, the successful ecological restoration of China’s Bohai Sea and Japan’s Seto Inland Sea—two of the most heavily stressed marine ecosystems globally—has emerged as both exemplary and somewhat perplexing cases. Their remarkable transformation is vital for safeguarding national ecological security and fulfilling global responsibilities (Jiang and Di, 2024), providing a valuable natural experiment for examining effective environmental governance under distinctly different political and economic systems.

However, this success shifts the analytical focus from technical or engineering challenges to a more fundamental issue of governance science. In the process of achieving policy objectives, the formulation of schemes accounts for only 10% of the overall success, while the remaining 90% depends on effective implementation (Allison and Zelikow, 1971). Consequently, a critical question arises: given that both countries ultimately succeeded in coastal pollution control and ecological restoration, did their policy implementation processes converge, or did they follow entirely different institutional logics? Furthermore, what institutional, political, and socio-economic factors shaped the distinct governance models that emerged in their respective contexts? Existing literature offers limited support in addressing this question. Studies either focus on single-case narratives (e.g., Gao et al., 2014; Takeoka, 2002) or engage in macro-level policy comparisons (e.g., Pan et al., 2023). There is a notable gap in the literature regarding systematic and nuanced comparative analyses of core implementation mechanisms. Additionally, classical policy implementation frameworks, primarily developed in Western contexts, still need to be tested and refined to enhance their applicability in explaining the complex dynamics of environmental governance in non-Western, particularly East Asian, settings.

By introducing and reconstructing the classical Sabatier-Mazmanian policy implementation model, this study systematically analyzes the policy execution processes related to pollution control in the Bohai Sea and Seto Inland Sea, aiming to identify the key variables and underlying mechanisms that influence the effectiveness of coastal pollution policy implementation under different political and economic contexts, thereby providing insights for the sustainable governance of large-scale marine ecosystems worldwide. The study reveals significant differences in

the governance processes between the two cases. The success of the Bohai Sea exemplifies a campaign-style mobilization approach, characterized by high-level political authority that, during specific periods, effectively consolidates resources and suppresses veto points to achieve rapid environmental targets. By comparison, the success of the Seto Inland Sea reflects an institutionalized collaboration model, depending on a legally anchored, multi-stakeholder, science-driven permanent consultation network. Through gradual learning and adaptation, this model continuously resolves conflicts and optimizes governance strategies. These two models are not simply a matter of superiority or inferiority but rather reflect the institutional endowments and historical trajectories specific to each country in confronting complex environmental challenges.

The marginal contributions of this study are primarily reflected in both theoretical and methodological dimensions. From the perspective of ecosystem governance theory, this research distills two distinct implementation paradigms for marine pollution control: campaign-style governance and institutionalized collaboration. This typology provides a crucial theoretical basis for global marine managers to weigh the trade-offs between two strategies: rapid restoration and long-term resilience. Methodologically, this study pioneers a novel operational approach for comparative analyses of marine environmental policies. While traditional research on marine governance often relies on descriptive case studies or macro-level policy comparisons, this work reconstructs the classical Sabatier-Mazmanian policy implementation framework into a systematic, multi-variable analytical tool capable of examining decades-long marine governance processes. This approach transcends simple policy-outcome correlations, delving deeper into the implementation black box, and provides a replicable methodology for analyzing how specific governance mechanisms lead to divergent ecological evolutionary trajectories in large marine ecosystems across varying institutional contexts.

The remainder of the study is structured as follows: Chapter 2 presents a literature review and identifies the theoretical gaps. Chapter 3 introduces the comparative case-study methodology employed and elaborates on the reconstruction of the classic Sabatier-Mazmanian policy implementation model. Chapter 4 provides the necessary exposition of the governance contexts and their evolution in the Bohai Sea and the Seto Inland Sea. Chapter 5 conducts a direct, parallel comparative analysis of the core variables across the two cases in strict accordance with the analytical modules of the reconstructed Sabatier-Mazmanian framework (hereafter referred to as the S-M model), with the aim of maximizing the articulation of the key differences between them. Finally, Chapter 6 summarizes the findings and offers policy recommendations.

2 Literature review

Across the globe, marine environmental governance shows varied institutional arrangements but converges on a common impediment—the last-mile gap between policy formulation and

governance practice, i.e., implementation difficulties. Marine ecological and environmental governance within the United Nations framework aims to establish a comprehensive management system. However, it often faces challenges such as de-globalization and insufficient enforcement capabilities (Quan, 2019, 2020). Scholars have argued that the future of marine governance hinges on whether sustainable models can be established among multiple actors, including states, civil society, and markets (Haas et al., 2022). The European Union's experience shows that regional organizations can play a leadership role in advancing global marine environmental protection by formulating policies that surpass the standards set by international treaties (Carpenter, 2012; Boyes et al., 2016; Devriese et al., 2025). China's marine environmental governance has exhibited characteristics such as diverse actor participation, a shift from reactive to proactive control approaches, diversification of policy tools, and an expansion of governance scope (Yu and Bi, 2019). Notably, in specific areas such as marine litter management (Yu and Cui, 2021), marine ranches (Yu and Zhang, 2020), and deep-sea fisheries (Yu and Wang, 2022), the policy system has evolved from initial exploration to optimized adjustment. Recent studies examine marine policy changes in specific regions using quantitative text-analysis methods (e.g., Shandong Province) (Su and Yang, 2018), construct comprehensive governance systems for particular issues (e.g., marine plastic pollution) (Yang et al., 2020), and implement land-sea coordination and regional linkages (Jin and Yu, 2025; Yue et al., 2023). Nevertheless, despite ambitious policy and regulatory initiatives undertaken by countries worldwide, the ultimate governance outcomes vary markedly. This suggests that policy success depends not only on the technical rationality of the policy texts themselves (Smith, 1973; Halperin, 1976; Ding, 2002) but is more crucially contingent on the concrete processes of policy implementation. In this implementation phase, policymakers establish organizational structures, mobilize policy resources, and engage in actions such as interpretation, public outreach, experimentation, regulation, coordination, and monitoring (Yu and Zhou, 2005; Jones, 1977; Devriese et al., 2025). Simultaneously, the cultivation of public support and community awareness is essential (Drews and van den Bergh, 2016; Akram et al., 2023). Consequently, understanding this implementation "black box" has become one of the central topics in global marine environmental governance research.

China's Bohai Sea and Japan's Seto Inland Sea, as global exemplars of successful governance of semi-enclosed seas, have attracted scholarly attention. However, these studies largely focus on the causes of the problems, the resulting impacts, and the ultimate governance outcomes, and they are predominantly situated within the natural sciences or rely on single-case analyses. In the social sciences, the existing literature on Bohai governance chiefly concentrates on evaluating its notable ecological restoration achievements and documenting a series of robust, government-led interventions. The common thread across these studies is that governance is depicted as being fundamentally driven by state power. Scholars note that the rapid economic development in the circum-Bohai region (Gao et al., 2014) lead to severe pollution of the

Bohai Sea from land-based sources, including traditional and emerging persistent organic pollutants (Meng et al., 2017) and microplastics (Gu et al., 2022). At the governance level, government leads governance actions and continues to advance them (Wang, 2022), while policy instruments rely primarily on command-and-control policy approaches, and the deployment of market-based and public-participation instruments remains insufficient (Pan et al., 2023). Meanwhile, local governments' economic growth targets have been shown to negatively impact nearshore water quality, revealing the unique central-local government relationships and the economic-environmental trade-offs inherent in China's environmental governance (Shen et al., 2021). Similar to Bohai Sea studies, the literature on the Seto Inland Sea likewise generally affirms the effectiveness of its governance. Confronted with severe pollution during the 1960s and 1970s (Okaichi, 2002), Japan initiated systematic governance by enacting dedicated laws, implementing strict total pollutant load controls, and undertaking large-scale infrastructure projects (Takeoka, 2002). Contemporary research concentrates on the Satoumi concept signaling a shift in governance philosophy from mere pollution control to an integrated coastal management approach that seeks human-nature harmony while delivering high productivity and biodiversity (Tanaka and Furukawa, 2020). It further highlights multi-stakeholder collaborative governance involving government, business, non-governmental organizations, research institutions, and the public (Tawa, 2021). These studies converge on a participatory, networked governance model. A few comparative studies focus on a single dimension—such as pollution-control outcomes and environmental legislation. For example, Yu et al. (2021) conducted a comparative analysis of the Bohai Sea and major international bays and found that reductions in total nitrogen and total phosphorus loads entering the sea from direct discharge sources in the Seto Inland Sea and the Bohai Sea exceeded 30%, indicating successful governance. Lu et al. (2015) compared the ecological restoration experiences of the Bohai Sea, the Seto Inland Sea, and the Chesapeake Bay, and identified problems in Bohai ecological restoration with regard to supporting institutions, monitoring and surveys, and funding sources. Li (2006) and Mi (2013) conducted comparative analyses of the international legal regimes applicable to the Bohai Sea and the Seto Inland Sea, as well as of major domestic legal instruments and environmental-protection documents and argued that China should establish a Bohai-specific regulatory framework. The literature on Bohai and Seto Inland Seas shows similar governance outcomes and also hints at divergent governance trajectories; however, these path differences are largely described implicitly rather than systematically explained, and the existing literature fails to sufficiently explain both why divergent implementation modes arise and how these modes function to achieve successful outcomes. The principal shortcoming of current research is the lack of a unified cross-national analytical framework that transcends national boundaries and integrates institutional differences to scrutinize the policy implementation processes associated with these two distinct paths. Accordingly, relevant policy implementation theories are needed as analytical tools to perform an in-depth analysis.

Research on policy implementation theory has historically coalesced around three dominant perspectives: top-down, bottom-up, and integrated approaches. The top-down perspective conceptualizes policy implementation as a goal transmission process under hierarchical control. Smith's model of the policy process constructs a four-dimensional analytical framework comprising idealized policy, implementing organizations, target groups, and environmental factors (Smith, 1973). Similarly, the model proposed by Van Meter and Van Horn (1975) identifies six key variables influencing the transformation from policy decisions to outcomes: policy objectives and standards, policy resources, systemic environment, characteristics of implementing agencies, implementation methods, and value orientations of implementers. The comprehensive framework developed by Sabatier and Mazmanian represents the apex of this school of thought. They critique the vagueness and operational complexity of the variables in Van Meter and Van Horn's model, and systematically propose seventeen sub-factors, categorized into three broad areas that influence effective policy implementation: the tractability of the problem, the ability of the statute to structure implementation, and non-statutory variables affecting implementation (Sabatier and Mazmanian, 1979, 1980). This framework provides an operationalized checklist for systematically evaluating and comparing the implementation processes of different policies. The bottom-up perspective emerges as a critical response to the technocratic rationality paradigm, shifting focus to the street-level realities of policy implementation. Lipsky's street-level bureaucrat theory highlights the pivotal role of frontline officials (e.g., local environmental officers), who, exercising discretionary power amid resource scarcity and conflicting goals, substantially reconstruct policies in practice (Lipsky, 1980). McLaughlin's interactive adaptation model emphasizes that policy implementation is a dynamic process of mutual adaptation and learning between local actors and policy objectives, with the final policy form co-constructed within the implementation arena (McLaughlin, 1987). The integrated approach seeks to develop more inclusive theoretical frameworks. Matland's ambiguity-conflict model posits that the mode of policy implementation depends on the ambiguity of policy objectives and the conflict over means, classifying implementation into four types: managerial, political, experimental, and symbolic (Matland, 1995). In recent years, scholars have increasingly emphasized the importance of institutional arrangements and collaborative governance, viewing policy implementation as a dynamic process involving interactions among political, administrative, and social actors (Sager and Gofen, 2022; Ansell et al., 2017), characterized by negotiations and discretion (Liu, 2010). Moreover, in Chinese public policy research on policy implementation capacity, the implementation process, and determinants of implementation, 66% of the literature from 1997 to 2004 concentrated on monetary and taxation domains, with environmental protection scarcely addressed (Wu, 2005). In the period 2003–2012, the themes largely centered on agriculture, education, and welfare policies, while environmental policy remained underexplored (Ding and Li, 2013). Consequently, from

the perspectives of public administration and policy science, research on the implementation of environmental policy—embodied by marine pollution control—exhibits a conspicuous deficiency.

In sum, the existing literature offers a comprehensive understanding of marine pollution governance, covering macro-level global policy frameworks, meso-level case practices, and micro-level implementation processes. However, several research gaps remain worthy of deeper exploration. First, there is insufficient progress from policy outcome comparisons to comparisons of the policy implementation process, necessitating a shift in research perspective from static to dynamic. Despite the critical role of implementation in public policy, existing literature lacks systematic, in-depth theoretical comparative analyses of its dynamic, complex, and strategic processes, often overlooking the underlying mechanisms behind governance effectiveness beyond policy texts. Second, the application of policy implementation theories needs to be strengthened, with research tools shifting from fragmented concepts to a more systematic framework. Although existing literature touches upon concepts such as intergovernmental relations and collaborative governance, few studies have systematically applied a mature, operational policy implementation framework to conduct panoramic, variable-oriented comparisons of marine governance practices. In particular, classic and widely recognized analytical frameworks such as S-M model have not been adequately applied to comparative studies of marine environmental governance. Third, there is a lack of cross-institutional and cross-cultural comparative studies grounded in a unified analytical framework. Current research has failed to thoroughly reveal how different political-administrative systems and socio-cultural backgrounds specifically and mechanistically shape the policy implementation process.

Therefore, the scholarly contribution of this study lies precisely in addressing the aforementioned gaps in the literature. By reconstructing the canonical S-M policy implementation model, this study develops a more comparative analytical framework that aims to transcend descriptive accounts and to systematically reveal and explain the underlying logic, operative mechanisms, and deep-seated institutional roots behind coastal pollution control in China and Japan.

3 Methodology

This study adopts a two-level research design that progresses from macro- to micro-level analysis. At the macro level, we employ the Most Similar Systems Design (MSSD) to establish the comparative logic for case selection, thereby ensuring the validity of cross-case comparisons. At the micro level, we base the analysis on the classic S-M policy implementation model and reconstruct it to develop a contextualized analytical framework capable of a deep examination of the policy implementation processes in the two countries. The following sections provide a detailed exposition of the components and rationale for this research design.

3.1 Macro-level research design: the most similar systems design and case selection

This study employs the MSSD as its core comparative methodology. The principle underlying the MSSD originates from John Stuart Mill (1843) “Method of Difference” and was later systematically adapted for comparative social research by scholars such as Przeworski and Teune (1970). According to Anckar (2020), MSSD offers indispensable advantages in specific research contexts: it is particularly useful in cross-country studies characterized by a limited number of research units and a researcher employing a variable-oriented approach; it facilitates the explanation of complex social processes; moreover, it enables the exclusion of a substantial number of potentially relevant explanatory variables from further analysis. Anckar (2008) argues that the applicability of MSSD is determined by the features of the research task and should be defined along three dimensions.

1. Level of analysis. This study operates at the systemic level, aiming to compare two holistic governance models shaped by fundamentally different state-society relations. Accordingly, it selects national-level cases that permit meaningful macro-structural comparisons.
2. Research strategy. The study follows an inductive/theory-building logic. It begins from an empirical puzzle: why do similar ecological crises give rise to markedly different yet successful governance trajectories? This puzzle-driven research strategy naturally aligns with the exploratory strengths of the MSSD.
3. Nature of the dependent variable. The core variation to be explained—the dependent variable—is the governance models adopted by countries in response to crises, which differ markedly in institutional arrangements and logics. Consequently, even though final governance outcomes appear similar, the dependent variable remains the governance form itself, which is varying across cases.

The MSSD approach strategically selects cases that are highly similar across a range of relevant background variables, differing primarily in key explanatory variables and research outcomes, with the aim of isolating the core causal mechanisms that lead to divergence in results. The case selection in this study adheres strictly to the comparative logic of the aforementioned MSSD, employing a strategic paired design to isolate the causal effects of the key explanatory variables. The Bohai Sea (China) and the Seto Inland Sea (Japan) constitute an ideal comparative pairing because they exhibit a high degree of similarity across three background variables, while embodying different types with respect to the core explanatory variable. The isomorphism of background variables provides effective control for potential confounding variables and yields a quasi-natural experimental setting to examine the generative mechanisms of different governance models.

1. There is a similarity in geographical morphology and ecosystem vulnerability. Both the Bohai Sea and the Seto

Inland Sea are typical semi-enclosed seas with limited water exchange capacity, making them prone to pollutant accumulation and enrichment. As a result, their ecosystems are highly sensitive and vulnerable to external pollution inputs, suggesting inherent homogeneity in their governance challenges.

2. The pollution problems in both regions exhibit homology and complexity. Both seas endure compounded land-based pollution from dense industrial zones, urban agglomerations with high population densities, intensive agriculture, and busy port shipping activities. Their main conflicts have evolved from early industrial pollutants (such as COD) to more recent issues centered around eutrophication, reflecting a high degree of consistency in the core technical and managerial challenges that policies need to address (Zheng and Zhai, 2021; Imai et al., 2006).
3. There is a similarity in the core tension between economy and environment. The Bohai Economic Rim and the Seto Inland Sea Industrial Belt are both vital economic engines for China and Japan, respectively. During periods of rapid economic growth, both regions vividly demonstrate the sharp tension between economic development and environmental protection, offering a unique opportunity to compare how each region balances and addresses this core contradiction.

Most crucial is that these two cases differ markedly on the core explanatory variable—state-society relations—maximizing theoretical variance for rigorous testing. China’s state-centric model and Japan’s networked corporatist model anchor the dual theoretical lineages of state-led governance and social coordination. A cross-case comparison of this dyad enables the study to transcend descriptions of national conditions and to construct an environmental governance framework with greater analytical generalizability, thereby providing global policy makers with a nuanced toolkit of governance pathways and their applicable conditions.

3.2 Micro-level analytical framework: the Sabatier-Mazmanian model

Currently, the actual pathway of policy implementation in China is a top-down model characterized by high-level policy initiation, hierarchical pressure, and multifaceted governance: the central authorities formulate the policy, while local authorities decompose and implement it (He and Kong, 2011; Ding, 2014). Japan’s policy implementation also exhibits top-down features. Therefore, among the top-down approaches to policy implementation, this study selects the Sabatier and Mazmanian (1980) comprehensive policy-implementation model, which is the most representative and best aligned with the present study. This model is a seminal work in public policy studies, proposed by Paul Sabatier and Daniel Mazmanian in 1980, providing a comprehensive multi-variable analytical framework to systematically explain the entire trajectory of a statute from its

enactment to the achievement of its intended objectives. Since its introduction, the model has become one of the most classic and widely cited normative frameworks in policy implementation research and has been widely applied to analyses of policy implementation capacity across domains such as monetary policy, taxation, education, and environmental protection, with substantial empirical support (Walsh, 1989; Fu and Chen, 2023). In environmental policy, Lester and Bowman (1989) used the S-M framework to examine the implementation of hazardous waste management policies across the 50 U.S. states, finding that technical uncertainty, the implementation capacity of policy agencies, and the importance of policy-targeted groups to the state economy all influence state-level policy implementation; Wakita and Yagi (2013) employed the model to identify the factors behind the relatively low implementation of Japan's integrated coastal management planning policy; Zheng et al. (2015) analyzed determinants of the implementation effectiveness of the pollutant-discharge fee collection policy across 30 Chinese provinces, thereby providing an empirical test of the S-M model's validity; Mao (2022) applied the model to analyze environmental policy implementation and its determinants in Sichuan Province, China.

The core argument of the S-M model is that the success or failure of policy implementation depends not only on the capacity and will of implementing agencies, but also on a series of interrelated variables throughout the policy lifecycle. This framework categorizes the key factors influencing policy implementation into three clusters of variables, as illustrated in Figure 1.

The first dimension is the “tractability of the problem.” This category of variables constitutes the objective constraints of policy implementation, focusing on the intrinsic attributes of the policy issue itself. The second dimension is the “ability of statute to structure implementation,” which emphasizes how the legal framework of the policy text shapes the implementation process. The third dimension involves “non-statutory variables affecting implementation,” capturing the dynamic macro-environment in which policy execution occurs and influencing it throughout the process. Together, these three clusters of variables interact to shape the policy implementation process, forming a dependent variable chain. This chain unfolds as a dynamic causal sequence: starting with the policy outputs generated by implementing agencies, moving to compliance by target groups, then to the actual and perceived impacts of the policy, and potentially feeding back to trigger significant revisions to the original statute.

3.3 Reconfiguring the implementation framework: an adaptation of Sabatier-Mazmanian model

The S-M model was developed within the institutional context of American pluralism in the 1970s. Its intricate causal architecture, comprising 17 variables, was meticulously designed to capture the subtleties of a political system characterized by dispersed authority and multiple veto points. However, the analytical challenge intensifies when this framework is applied to a comparative study of governance systems operating under fundamentally divergent institutional logics.

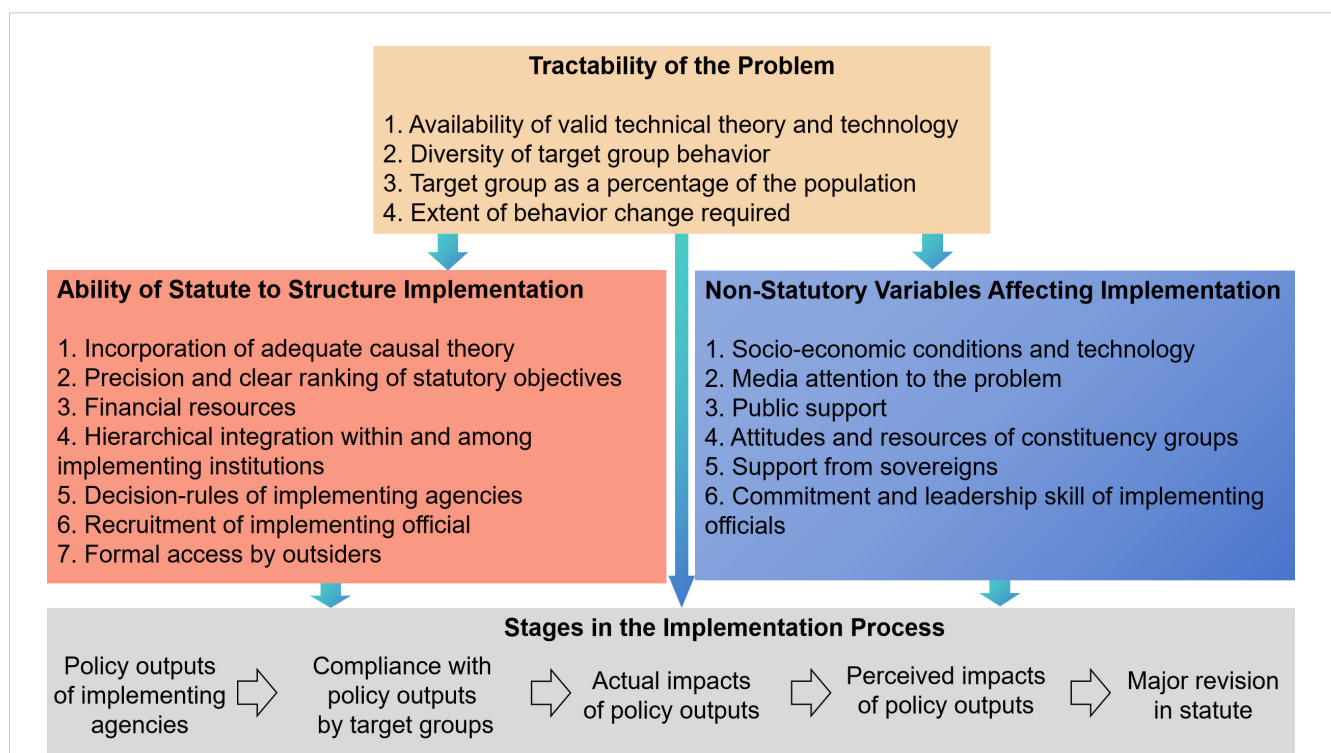


FIGURE 1
The Sabatier-Mazmanian policy implementation model.

The core issue is not whether the 17 original variables are present or absent in China and Japan, but rather how their relative weight, causal precedence, and interactive modes are profoundly reconfigured by each nation's state-society structure. To operationalize this critical perspective, this study defines state-society relations as the institutionalized patterns of power interaction between public authorities and social actors. The classic S-M model rests on an implicit theoretical foundation of pluralism: autonomous, mutually competing interest groups exert bottom-up influence on a relatively neutral state. However, this theoretical assumption is challenged in our cases. China's governance regime is characterized by state-centrism: state power wields strong social penetrability and mobilizes social actors in a top-down manner. Japan's model more closely resembles a corporatist or networked governance structure; wherein key social stakeholders are not merely external pressure groups but co-governing partners integrated into an institutionalized process of deliberative consensus-building. This fundamental difference in state-society forms makes the direct application of the original S-M framework analytically problematic. Moreover, as Jiang et al. (2024) contend, the application of Western policy research requires localization and contextualization. In view of this, a rigorous reconceptualization of the S-M model becomes not merely a methodological choice but a theoretical imperative, aimed at foregrounding these divergent state-society dynamics and ultimately developing distinct ideal models for marine pollution governance.

This study undertakes this task by abstracting the model's core functional mechanisms and reorganizing its variables to develop a more parsimonious yet analytically robust framework, specifically tailored for cross-system comparison. As shown in Figure 2, this adapted framework sheds light on the distinct macro-drivers and implementation dynamics in the two cases, while incorporating and

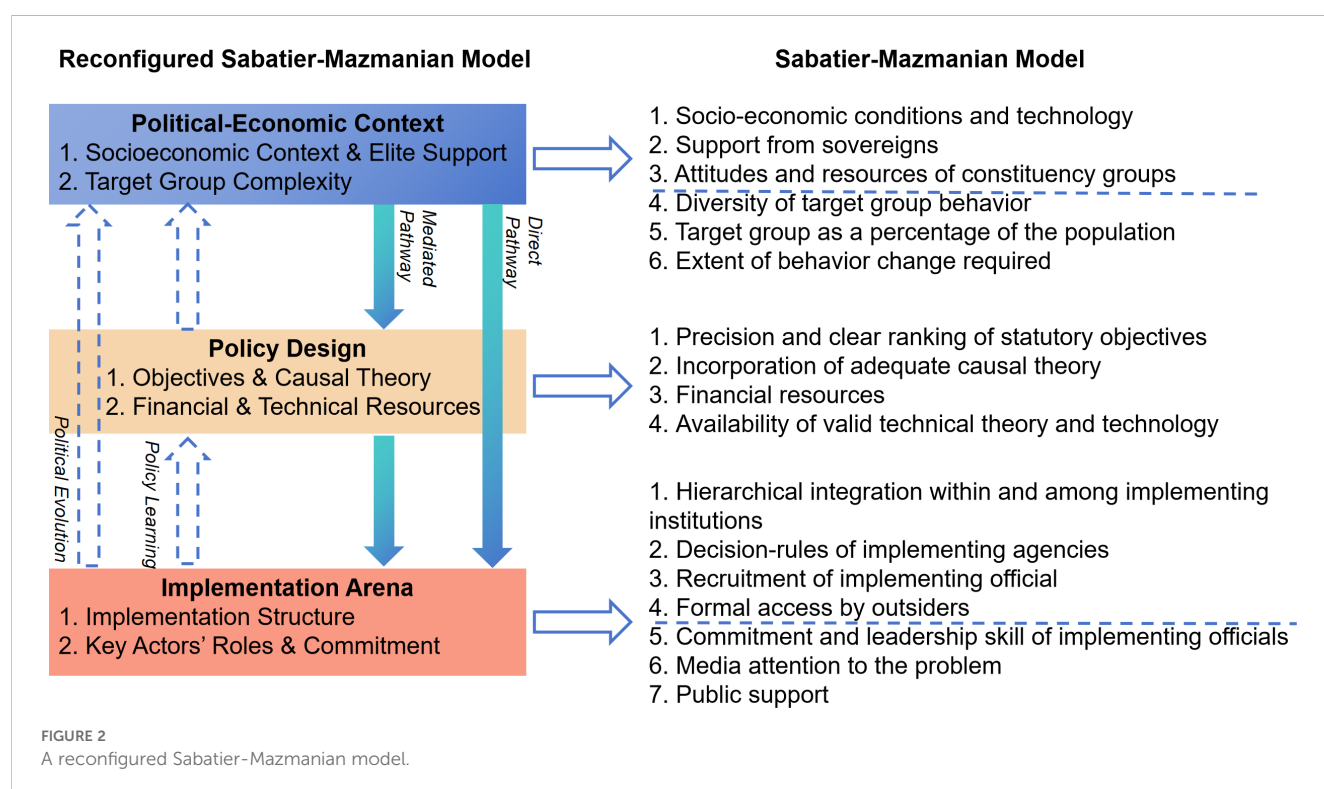
restructuring all 17 original variables. The reconfigured model is organized around three hierarchically nested dimensions—political-economic context, policy design, and the implementation arena—which are interconnected through dual causal pathways and dynamic feedback loops.

(1) Political-economic context.

This top-tier dimension delineates the macro-structural conditions that either constrain or enable the entire implementation process. It integrates six original S-M variables into two core variables: Socioeconomic Context & Elite Support and Target Group Complexity. The Socioeconomic Context & Elite Support variable captures the overall political and economic landscape, synthesizing three variables from the original S-M framework: socio-economic conditions and technology, support from sovereigns, and the attitudes and resources of constituency groups. The logic behind this integration is that these elements collectively form the macro-level political climate, providing stable structural supports or constraints on policy implementation. The Target Group Complexity variable combines three highly correlated original variables: diversity of target group behavior, the target group as a percentage of the population, and the extent of behavior change required. It conceptualizes the challenge of regulating polluters as a multifaceted issue defined by the scale, heterogeneity, and depth of necessary behavioral change.

(2) Policy design.

This intermediate dimension evaluates the inherent qualities and capacities of policy instruments. It acts as a crucial link between the macro environment and frontline implementation. The newly integrated variable, Objectives & Causal Theory, combines the original S-M variables of precision and clear ranking of statutory



objectives, and the incorporation of adequate causal theory. It posits that a well-designed policy must not only have clear objectives but also possess a sound, evidence-based understanding of how to achieve them. The second newly integrated variable, Financial & Technical Resources, combines the original model's financial resources and the availability of valid technical theory and technology, emphasizing that adequate funding and technology are core components of policy capacity.

(3) Implementation arena.

This dimension represents the convergence point between policy and practice, examining the interactions among institutional structures and key actors that ultimately determine policy outputs. Implementation Structure captures the formal institutional arrangements, which can be seen as the “hardware” of governance. It integrates four variables from the original model: hierarchical integration within and among implementing institutions, decision rules of implementing agencies, recruitment of implementing official, and formal access by outsiders. This dimension aims to reveal whether the governance system is designed for top-down command transmission or for networked consultative coordination. Key Actors' Roles & Commitment focuses on the dynamic human factors in the implementation process, representing the “software” of governance. Its innovative aspect lies in incorporating not only the commitment and leadership skills of officials but also reconceptualizing media attention and public support from passive contextual factors into active intervention forces. Within this framework, the media and the public are regarded as active participants alongside officials, forming a volatile “actor-assemblage” that exerts real-time influence throughout the implementation process. This separation of structure and agency allows for a more nuanced analysis of how formal institutions interact with dynamic human agency, collectively shaping the ultimate success or failure of a policy.

In addition, this three-dimensional framework is driven by two crucial dynamic mechanisms that enable a more sophisticated comparative analysis. First, it incorporates dual causal pathways: a traditional mediated pathway in which the political context shapes policy design, subsequently affecting the implementation arena; and a direct pathway, where macro-political forces can bypass policy design to directly reconfigure the implementation arena. Second, it features dynamic feedback loops: a policy learning loop (from arena to design) and a political evolution loop (from arena to context), capturing how implementation outcomes iteratively reshape both the policy itself and the broader political landscape. These mechanisms are essential for explaining the divergent trajectories of command-and-control mobilization versus adaptive, consultative governance.

4 Evolution of pollution control in the Bohai and Seto Inland Seas

4.1 Biogeographical characteristics of the Bohai and Seto Inland Seas

The Bohai Sea is China's only semi-enclosed inland sea and the most ecologically vulnerable among the country's coastal waters.

Covering approximately 77,000 square kilometers, it includes the main sea area along with Liaodong Bay, Bohai Bay, and Laizhou Bay. Surrounded on three sides by land, it exchanges limited water with the Yellow Sea through the Bohai Strait on the eastern side, as shown in [Figure 3](#). Ecologically and economically, the Bohai Sea is not only a traditional hub for fishing and salt production but also a strategic center for modern industrial development. Its coastal area hosts China's densest clusters of heavy industries, ports, and urban zones, and underpins several national strategies, including the coordinated development of Beijing, Tianjin, and Hebei.

The Seto Inland Sea is Japan's largest inland sea, surrounded by the islands of Honshu, Shikoku, and Kyushu, covering approximately 23,000 square kilometers. Geographically, it stretches roughly 450 kilometers from east to west, with a width ranging from only 15 to 55 kilometers from north to south. It connects to the Pacific Ocean via the narrow straits of Kii and Bungo, and to the Sea of Japan through the Kanmon Strait in the west, as shown in [Figure 4](#). After World War II, Japan entered a period of rapid economic growth, shifting its national focus to heavy and chemical industries. Meanwhile, coastal areas of the Seto Inland Sea were designated as “New Industrial Cities” and “Special Industrial Development Areas,” leading to the quick formation of a massive industrial belt. Since the 1950s, the rapid expansion of heavy industry and shipping has caused severe water and seabed pollution, as well as frequent red tides, compelling Japan to embark on a challenging path of pollution governance in the Seto Inland Sea.

4.2 The evolution of pollution control in the Bohai Sea

4.2.1 The first stage: planning-led exploration and challenges (2001–2017)

In 2001, the State Council approved the “Bohai Blue Sea Action Plan” (hereinafter referred to as the “Blue Sea Plan”), marking the first time that the environmental governance of the Bohai Sea was elevated to a national strategic level. The plan focused primarily on controlling land-based pollution, incorporating a range of multi-dimensional engineering measures such as industrial restructuring, promotion of clean production, total pollutant load control into the sea, and ecological restoration. During the “Tenth Five-Year Plan” period (2001–2005), 236 projects were completed under the plan, with a total investment of 18.81 billion yuan. However, the project completion rate was only 57.41%, meaning that over 40% of the planned projects were not effectively implemented. At the implementation level, the operational efficiency of completed projects became a prominent issue: over 22% of urban sewage treatment plants operated at less than 60% of their actual load capacity, and the harmless treatment rate of urban waste was only 28.8% ([National Development and Reform Commission et al., 2006](#)). In terms of governance effectiveness, although water quality deterioration was somewhat contained, nearshore waters continued to suffer from land-based pollution, with inorganic nitrogen, active phosphates, and petroleum substances exceeding

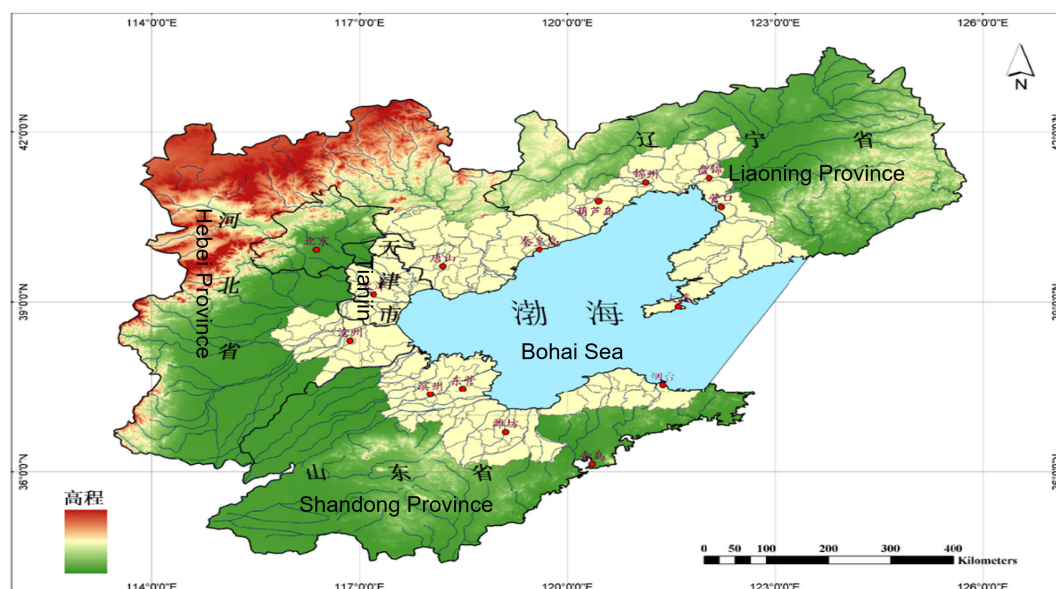


FIGURE 3

Map of the Bohai Sea Source: Master Plan for Bohai Sea Environmental Protection (2008–2020), <https://www.ndrc.gov.cn/fggz/hjzy/hjyb/200902/P020190911470062489598.pdf>.

standard limits. By 2005, total offshore Chemical Oxygen Demand (COD) emissions had increased to 1.5 million tons—nearly 400,000 tons higher than the baseline forecast—indicating that the Blue Sea Plan failed to achieve its primary goal of reducing land-based pollution.

To address these challenges, the State Council held an on-site working conference on Bohai environmental protection in 2006, emphasizing the need to adjust the industrial structure and implement comprehensive management. Subsequently, the

government issued the “Master Plan for Bohai Sea Environmental Protection (2008–2020)” (hereinafter referred to as the “Environmental Protection Plan”), with a planned total investment of approximately 126.67 billion yuan. The plan aimed to enhance governance by establishing five major systems: pollution prevention and ecological protection in the Bohai Sea, control and comprehensive management of land-based pollution sources, integrated management and remediation of basin water resources and water environments, scientific and technological support for

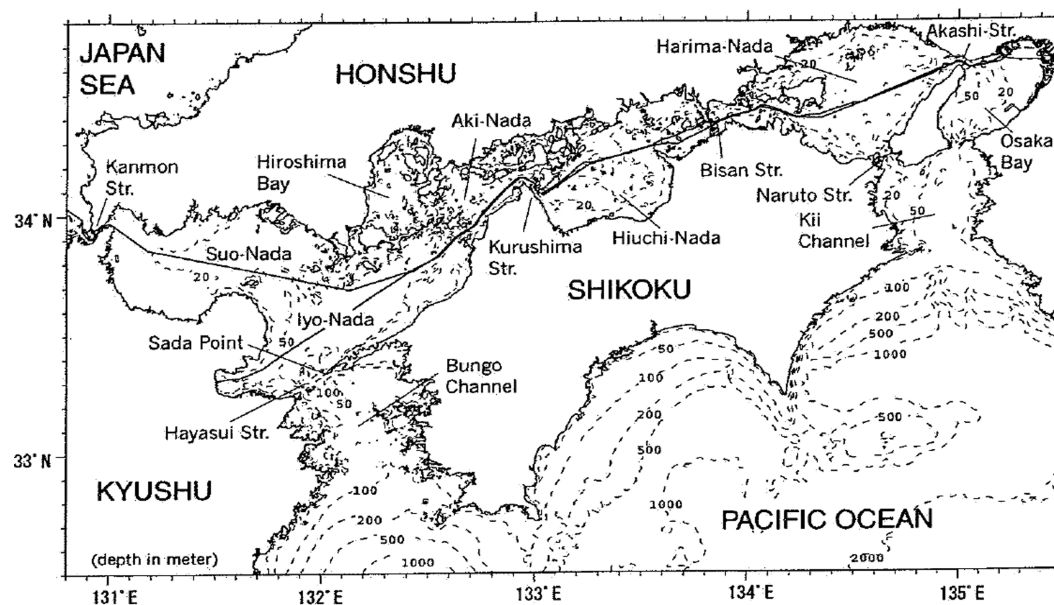


FIGURE 4

Map of the Seto Inland Sea Source: Takeoka, H. (2002). Progress in Seto Inland Sea research. *J. Oceanogr.* 58, 93–107.

Bohai Sea environmental protection, and environmental monitoring in the Bohai Sea. Additionally, a cross-departmental coordination mechanism for Bohai Sea environmental protection was established to tackle major issues. During the “Twelfth Five-Year Plan” period (2011–2015), water quality in the Bohai Sea improved, with the proportion of Class I and II water quality rising by 14.3%, and the proportion of Class IV or worse water quality decreasing by 4.1% (General Office of the Ministry of Environmental Protection et al., 2017). However, this positive trend was not stable, and overall governance results still fell short of the anticipated targets.

4.2.2 The second stage: campaign-driven comprehensive governance (2018–present)

Since the 18th National Congress of the Communist Party of China, the central government’s emphasis on ecological environmental protection has significantly increased, laying a solid institutional foundation for the Bohai Sea governance to enter a new phase. The 2015 “Water Pollution Prevention and Control Action Plan” and the 2017 “Action Plan for Prevention and Control of Pollution in Coastal Waters” established the framework for water environment governance both nationally and in coastal regions. Notably, the 2017 revision of the “Marine Environmental Protection Law of the People’s Republic of China” legalized the “Ecological Protection Redline” system, providing a strong legal basis for marine environmental management.

In 2018, the central decision-making authority elevated the comprehensive governance of the Bohai Sea to the level of a “national pollution control and prevention campaign,” marking a turning point in the region’s management. In June, the Central Committee of the Communist Party of China and the State Council issued relevant opinions, officially launching the campaign. In November, the Ministry of Ecology and Environment, together with two other ministries, jointly issued the “Action Plan for the Comprehensive Governance of the Bohai Sea” (hereinafter referred to as the “Campaign Plan”), signifying the formal initiation of a

series of strict regulatory measures. The governance actions in this new phase focus on four major areas: land-based pollution control, marine pollution control, ecological protection and restoration, and environmental risk prevention. Specific measures include: a comprehensive source tracing and investigation of all marine outfalls; the legal phase-out of outdated production capacities and enforcement of pollution discharge permits with legal certificates; the establishment and implementation of provincial bay chief systems in Liaodong Bay, Bohai Bay, and Laizhou Bay, with responsibilities delegated to coastal cities; and the prohibition of new reclamation projects. Simultaneously, the Central Ecological and Environmental Protection Inspection (CEEPI) prioritized the Bohai Sea, using inspections to drive rectification. After three years of efforts, the campaign’s objectives were declared achieved. By 2020, the area of water in nearshore waters classified as excellent (Class I and II) reached 82.3%, an increase of 15.3 percentage points compared to 2017; all 49 national-controlled river sections entering the sea eliminated Class V or worse water quality; and a total of 8,891 hectares of coastal wetlands and 132 kilometers of shoreline were rehabilitated (The State Council Information Office of the People’s Republic of China, 2024). The plans, programs, and laws associated with Bohai Sea governance are summarized in Table 1.

4.3 The evolution of pollution control in the Seto Inland Sea

4.3.1 The first stage: crisis-driven legislation and point source control (1970–1977)

As the environmental crisis became increasingly severe, protests led by fishermen and coastal residents grew, exerting significant pressure on enterprises and local governments. In response, some local governments took the initiative by signing Pollution Control Agreements with enterprises, attempting to impose initial constraints on wastewater discharges. This series of bottom-up pressures ultimately galvanized national legislative responses. In

TABLE 1 Plans, programs, and laws related to Bohai Sea governance.

Year	Plans, programs, and laws	Issuing authority
2001	Bohai Blue Sea Action Plan	State Environmental Protection Administration (now the Ministry of Ecology and Environment)
2006	Master Plan for Bohai Sea Environmental Protection (2008–2020)	National Development and Reform Commission, Ministry of Environmental Protection, Ministry of Housing and Urban-Rural Development, Ministry of Water Resources, State Oceanic Administration
2015	Water Pollution Prevention and Control Action Plan	The State Council
2016	The 13th Five-Year Plan for Ecological and Environmental Protection	The State Council
2017	Action Plan for Prevention and Control of Pollution in Coastal Waters	Ministry of Environmental Protection and 9 other ministries and commissions
2017	Marine Environmental Protection Law of the People’s Republic of China	The Standing Committee of the National People’s Congress
2018	Action Plan for the Comprehensive Governance of the Bohai Sea	Ministry of Ecology and Environment, National Development and Reform Commission, Ministry of Natural Resources

1970, Japan's National Diet enacted the "Water Pollution Prevention Act," establishing the first comprehensive legal framework for water pollution control nationwide. Given the unique ecological vulnerability and severity of issues in the Seto Inland Sea, the Diet passed the landmark "Act on Provisional Measures for Environmental Conservation of the Seto Inland Sea" (hereafter referred to as the "Provisional Act") in 1973 and subsequently formulated the "Seto Inland Sea Environmental Conservation Basic Plan." This Act was Japan's first comprehensive environmental legislation targeting a specific sea area, implementing the most stringent regulations on COD concentrations (aiming to reduce industrial-source COD by half) and establishing a licensing system for the construction and operation of specific coastal facilities. This phase of governance can be defined as a crisis-driven legislative intervention, where highly enforceable specialized laws were employed to directly control key pollution sources.

4.3.2 The second stage: systemic eutrophication management (1978–2011)

Although the strong interventions in the first stage effectively controlled industrial point-source pollution, the continued occurrence of large-scale red tides exposed the limitations of the earlier "point source-hazard" linear causal model. As scientific understanding deepened among both the scientific community and policymakers, the root cause of the issue was redefined as eutrophication—an ecosystem imbalance resulting from excessive nutrient inputs, primarily nitrogen (N) and phosphorus (P). These nutrients mainly originate from urban domestic wastewater and agricultural non-point source pollution. To address this problem, in 1978, Japan revised the "Provisional Act" into a permanent law, renaming it the "Act on Special Measures for Environmental Conservation of the Seto Inland Sea" (hereinafter referred to as the "Seto Inland Sea Act"). The same year, the Water Pollution Prevention Act was also amended, officially establishing a Total Pollutant Load Reduction System for Water Quality (TPLRS) aimed at controlling the environmental capacity of river basins. This system operated through a hierarchical and clearly delineated mechanism: first, the Director-General of the Environment Agency (now the Minister of the Environment) formulated the national Basic Policy for Total Load Reduction, setting overall reduction targets; then, the governors of 11 prefectures (later expanded to 13) drafted local Total Load Reduction Plans, allocating reduction tasks among industrial, domestic, and other pollution sources. The TPLRS was implemented initially in 1979; in 1991 (the third plan), efforts focused on guiding reductions of nitrogen and phosphorus; and ultimately, in 2001 (the fifth plan), nitrogen and phosphorus were formally incorporated as main indicators for total load control (Ministry of the Environment and Japan, and Ministry of Environmental Protection of the People's Republic of China, 2010). The process of environmental governance in the Seto Inland Sea, along with related laws and regulations, are detailed in Table 2.

From 1979 to 2023, pollutant loads flowing into the Seto Inland Sea significantly declined. The average daily COD load was

drastically reduced from 1,012 tons to 339 tons, a decrease of 66.5%; the average daily total nitrogen (TN) load fell from approximately 666 tons to 361 tons, a reduction of about 45.8%; and the average daily total phosphorus (TP) load decreased from roughly 62.9 tons to 22.9 tons, a reduction of approximately 63.6%. This systematic reduction in pollution loads led to a substantial improvement in water quality within the sea. The iconic ecological disaster of eutrophication—red tide—fell from nearly 300 occurrences at its peak to around 100 annually (Ministry of the Environment, 2005). These achievements represent a decisive victory for systemic governance centered on total load control, and the problem of eutrophication in the region has been fundamentally curtailed.

4.3.3 The third stage: toward adaptive management for "Satoumi" (2012–present)

However, as the eutrophication issue was addressed, some bays with excessively clean water experienced oligotrophication, such as declining fish catches and fading cultivated seaweed. This exposed the limitations of a governance approach solely focusing on pollution reduction. Consequently, the governance philosophy evolved from pursuing clean water to cultivating an abundant and productive ocean, known as "Satoumi" (sea of harmony), which emphasizes harmonious coexistence between humans and nature. This shift was institutionalized through adaptive

TABLE 2 Legislative evolution of environmental governance in the Seto Inland Sea.

Year	National-level legal and institutional developments
1967	Establishment of water quality environmental standards under the Basic Law for Environmental Pollution Control, with progressive application to the Seto Inland Sea.
1970	Implementation of nationwide, uniform, concentration-based effluent regulations under the Water Pollution Prevention Act.
1973	Enactment of the Act on Provisional Measures for Environmental Conservation of the Seto Inland Sea.
1974	Implementation of a 50% reduction mandate for COD from industrial effluent under the Provisional Act.
1978	Establishment of the Seto Inland Sea Environmental Conservation Basic Plan based on the Provisional Act.
1978	The Provisional Act was amended and made permanent, becoming the Act on Special Measures for Environmental Conservation of the Seto Inland Sea; this law introduced the Total Pollutant Load Reduction System for COD.
1980	Introduction of administrative guidance for phosphorus (P) reduction.
1993	Establishment of water quality and effluent standards for nitrogen (N) and phosphorus (P).
1996	Nitrogen (N) was added to the scope of administrative guidance.
2000	Revision of the Seto Inland Sea Environmental Conservation Basic Plan.
2001	Nitrogen (N) and phosphorus (P) were included as target substances in the 5th Total Pollutant Load Control Plan.

management principles (Central Environment Council, 2020; Yanagi, 1998). The transformation of this governance goal was formally enshrined in law through major amendments to the Seto Inland Sea Act in 2015 and 2021.

The new governance objectives reflect three key strategic shifts: First, the approach transitioned from uniform nutrient reduction to refined nutrient management. The 2021 legislative amendments allowed prefectural governors to dynamically regulate and even to conduct targeted supplementation of nutrient levels in oligotrophic sea areas based on scientific advice (Central Environment Council, 2021). Second, the focus of environmental governance expanded from pollution control to proactive habitat restoration and the creation of critical ecosystems such as seagrass beds and tidal wetlands. Third, the policy agenda incorporated emerging challenges such as marine plastic debris (Ministry of the Environment, 2019), while the governance structure evolved from government-led initiatives to a collaborative, multi-stakeholder network integrating non-profit organizations (NPOs), industry, and local communities to realize the vision of an abundant sea of the Reiwa Era (Central Environmental Council et al., 2012).

5 Comparative analysis of policy implementation

This chapter aims to conduct a systematic comparative analysis of the policy implementation processes in the Bohai Sea and the Seto Inland Sea. Its internal structure strictly adheres to the logical sequence of reconstructed S-M analytical framework (as depicted in Figure 2) and examine, item by item, the key variables that account for the divergence in marine pollution governance models between China and Japan.

5.1 Political-economic context

5.1.1 Socioeconomic context and elite support

This section analyzes the fundamental political-economic context and the nature of elite support that shaped the governance trajectories of the Bohai Sea and the Seto Inland Sea. The core finding is that although both cases originated from environmental crises induced by economic development, the logic behind the formation of their elite consensus differs. The governance process in the Bohai Sea is characterized by a fragmented elite consensus under a mainstream developmentalist paradigm, which has been forcibly integrated through top-down political will since 2018. In contrast, the Seto Inland Sea experienced a crisis-driven integration of elite consensus, which was subsequently institutionalized through a permanent legal framework. The major differences are summarized in Table 3.

(1) Bohai Sea: from fragmented elite consensus to mandatory integration.

In the early phase of Bohai Sea governance (2001–2017), policy implementation consistently operated within a developmentalist political-economic paradigm at the national level. This paradigm

explicitly prioritized economic growth, exemplified by positioning the Bohai Economic Rim as the third national growth pole after the Pearl River Delta and the Yangtze River Delta. This macro-strategic orientation led to a structural divergence in the priorities of governance elites. On one hand, the central environmental authority (formerly the State Environmental Protection Administration, now the Ministry of Ecology and Environment) developed systematic governance plans—namely, the Blue Sea Plan. On the other hand, within the existing policy hierarchy, environmental regulations were systematically subordinated, with their authority consistently suppressed by local governments and industrial sectors that dominated the economic growth agenda. The fiscal principle established by the Blue Sea Plan—stating that “local governments are primary actors with appropriate national support”—resulted in a mismatch between power and responsibility in environmental governance. While decentralizing governance responsibilities, it failed to restructure the incentive framework for local actors, whose rewards and penalties remained closely tied to economic growth. This led to the systematic marginalization of environmental goals at the local level.

However, the Campaign Plan enacted in 2018 fundamentally reorganized the political-economic context and elite support. It elevated environmental issues to an unprecedented strategic level, effectively addressing the longstanding problem of fractured elite consensus. Firstly, the Campaign Plan redefined the nature and priority of the problem through an authoritative official narrative. The document explicitly stated that the ecological and environmental problems of the Bohai Sea had become a bottleneck for the sustainable socio-economic development of the circum-Bohai region. It further clarified that the formulation of the plan was grounded in the comprehensive implementation of the decisions and deployments of the Party Central Committee and the State Council. This framed the Bohai Sea environmental issue as a fundamental obstacle hindering the national regional development strategy and a top-tier political task that must be accomplished, thus providing a legitimate basis for the mobilization of powerful administrative and political resources. Secondly, the structure of elite support shifted from a negotiated to a directive model. The Campaign Plan was not a proposal requiring prolonged

TABLE 3 Differences in political-economic context between Bohai and Seto Inland Seas' cases.

Case	Period	Socioeconomic context	Elite support
Bohai Sea	2001–2017	Economic growth-oriented	Fractured elite consensus
	After 2018	Environmental protection-oriented	Coerced elite consensus integration
Seto Inland Sea	1960s	Socioeconomic crisis	Integration of dispersed interests
	1973–1978		Institutionalization of elite support: Seto Inland Sea Act

negotiations and consensus-building among local governments and central ministries and commissions; rather, it was a directive backed by top-level political will. Its safeguard provisions explicitly required the local governments of the three provinces and one municipality (Liaoning, Hebei, Shandong, and Tianjin) to “enhance their political stance” and rigorously implement the “Party-and-government joint responsibility system and dual responsibility for leaders in their respective posts” for ecological and environmental protection. This institutional design ensured that local administrative heads and Party secretaries would jointly bear responsibility for environmental outcomes, eliminating institutional incentives to prioritize economic development over environmental protection and coercively aligning the objectives of all key actors with the central agenda. Finally, the implementation of this new consensus was ensured through institutionalized supervision mechanisms. The Campaign Plan outlined a five-step approach—investigation, assignment, verification, interview, and special inspection—to strengthen oversight. This embedded the high-level, cross-departmental vertical oversight tool, the Central Ecological and Environmental Protection Inspection (CEEPI), into the governance framework for the Bohai Sea. Such a mechanism effectively bypasses traditional veto points rooted in departmental interests and local protectionism, ensuring that the shift in elite support does not remain merely rhetorical or documentary but translates into tangible, accountable actions.

(2) Seto Inland Sea: from crisis-driven consensus integration to institutionalized adaptive adjustment.

The formation of elite consensus in the Seto Inland Sea followed a different pattern. It did not originate from a top-down political decree, but rather from an intense socioeconomic crisis that forced the realignment of previously disparate stakeholder interests. In the late 1960s, catastrophic red tides devastated the region’s pillar industries of fishing and aquaculture, while severe pollution-related diseases such as Minamata disease sparked a public health crisis and widespread social protests. This crisis fundamentally altered the cost-benefit calculus for all key actors. For central development ministries, such as the former Ministry of International Trade and Industry (now the Ministry of Economy, Trade and Industry), local prefectural governments, and large industrial groups, environmental degradation was no longer a tolerable externality. Instead, it became a clear and present existential threat to both economic stability and social order. This shared perception of crisis led to the formation of a powerful, cross-sectoral problem-solving coalition, which culminated in the institutional milestone of the promulgation of the “Provisional Act” in 1973.

A key innovation of this legislation was its ability to institutionalize and perpetuate the hard-won political consensus. Specifically, the Provisional Act established the Seto Inland Sea Environmental Conservation Council, which effectively transformed potential veto points—including competing central ministries, local governments with protectionist tendencies, and powerful industrial groups—into integral nodes within a mandatory deliberative network. This institutionalized elite support network has provided a stable foundation for the governance system’s

development over the past five decades, allowing it to undergo adaptive shifts in governance objectives—from pollution control to ecosystem-based management, and ultimately toward the practice of the “Satoumi” concept.

5.1.2 Target group complexity

Target group complexity is a core variable that defines the starting point of policy implementation models. Although governance actions in both the Bohai Sea and the Seto Inland Sea begin with highly complex situations, there are fundamental differences in the nature and structural configuration of this complexity. The core finding of this section is that Bohai Sea governance confronts an atomized and diffuse complexity, which diminishes the effectiveness of conventional regulatory tools, thus creating conditions for the state to adopt a campaign-style political mobilization model. However, Seto Inland Sea governance faces a structured and concentrated complexity, offering clear institutional leverage points that allow for the construction of a governance model based on law and channeled through interest group negotiations. The main differences are summarized in [Table 4](#).

(1) Bohai Sea: atomized complexity necessitating political mobilization.

The core characteristics of the complexity faced by Bohai Sea governance are atomization and diffusion. Firstly, in terms of scale, its governance object is immense. The scope of Bohai Sea governance covers three provinces and one municipality (Liaoning, Hebei, Shandong, and Tianjin), with a focus on the land area of Tianjin and 12 other coastal prefecture-level cities, spanning 132,000 square kilometers ([Ministry of Ecology and Environment et al., 2018](#)). This region had a population of approximately 60 million in 2005 and surged to 230 million by 2018, with a regional GDP reaching 15.76 trillion yuan, accounting for 17.8% of China’s total. The number of industrial enterprises above a designated size alone exceeded 59,345 ([National Bureau of Statistics of the People’s Republic of China, 2019](#)). More critically, this massive scale is not concentrated in a few large polluters but is dispersed across a broad geographical area with diverse socio-economic structures. This diffusion is vividly manifested in the heterogeneity of pollution sources. Of Bohai’s pollution load, 80% is land-based, while maritime sources account for only 20%. Within the vast land-based pollution, the composition is extremely complex, including industrial point sources, agricultural non-point sources, urban domestic pollution, and “scattered, messy, polluting” enterprises. This means that regulators are not confronted with a few major polluters, but with a complex network composed of countless anonymous, independent pollution points and areas, lacking unified channels for interest

TABLE 4 Differences in target group complexity between Bohai and Seto Inland Seas’ cases.

Case	Target group complexity
Bohai Sea	Massive, atomized, dispersed, complex
Seto Inland Sea	Massive, structured, centralized, complex

expression and effective industry self-regulation. This atomized complexity becomes a significant resistance field when governance objectives require deep behavioral changes. As governance demands upgrade from technical adaptations in end-of-pipe control to structural reforms—such as plant shutdowns and industry restructuring—each atomized polluting entity becomes a potential veto point. Therefore, when conventional hierarchical regulatory tools fail in such a fragmented governance arena, top-down, campaign-style governance driven by strong political will becomes a seemingly necessary strategy. Only through this political mobilization can the resistance field composed of countless fragmented interest be overcome in the short term, enabling the enforcement of profound behavioral changes.

(2) Seto Inland Sea: structured complexity enabling consultative governance.

The complexity faced by the Seto Inland Sea in the 1970s was characterized by structuralization and centralization. The 13 prefectures along the Seto Inland Sea coast concentrated approximately 30 million residents, accounting for 25% of Japan's population, and housed over 102,000 industrial and commercial enterprises. Their industrial output reached as high as 70.48 trillion yen, representing 54.2% of the total industrial output of national key controlled zones (Ministry of the Environment, 2024). Despite the similarly large scale, its complexity displayed a high degree of structural concentration, both geographically and industrially. The primary regulatory targets were not dispersed polluters but several large heavy chemical industrial complexes (e.g., steel, petrochemical, paper), with the interests of these enterprises being aggregated and represented through highly organized industry associations such as the Japan Iron and Steel Federation. This concentration of industrial power gave rise to a powerful counter-mobilization initiated by equally organized collective actors—namely, an alliance composed of Fisheries Cooperative Associations (FCAs) and coastal communities whose livelihoods were directly threatened. As a result, the core of the governance challenge was not managing an amorphous network of atomized individuals but confronting a sharply defined, nearly polarized conflict structure. The nature of regulation also transformed from a potentially intractable environmental problem into a manageable political negotiation among a few powerful, organized corporate stakeholders. Moreover, this structured complexity provided clear institutional pathways for driving profound behavioral change—eschewing reliance on extraordinary political pressure and instead employing a series of institutionalized tools. For example, the “Four Major Pollution Lawsuits” provided victims with judicial channels to pressure polluters; the “Act on the Burden of Pollution Prevention Project Costs on Business Operators” (Law No. 133 of 1970) explicitly legislated corporate responsibilities for pollution costs; and local governments’ signing of Pollution Control Agreements with enterprises transformed emission reduction targets into legally binding commitments. Because the governance targets were clear and structured, legal instruments, lawsuits, and negotiations had actionable targets and institutional interfaces.

5.2 Policy design

5.2.1 Objectives and causal theory

Policy objectives and their embedded causal theories serve as the cognitive anchor and strategic core of the entire implementation process. Therefore, effective policy design is not merely a technical blueprint; it should embody a coherent problem narrative that legitimizes actions and powerfully shapes long-term governance trajectories. Both the Bohai Sea and the Seto Inland Sea have undergone similar evolutions in their policy objectives, from simple total pollution load control to complex ecosystem-based management. However, the policy formation logics driving this convergence are markedly different. Bohai's policy design exhibits characteristics of punctuated reconfigurations, with its objectives and causal theories undergoing periodic, top-down holistic reconstruction. By comparison, policies in the Seto Inland Sea reflect a pattern of cumulative, adaptive evolution, where objectives and causal theories are progressively and continuously refined through institutionalized processes of scientific assessment authorized by law and stakeholder consultation. The main differences are illustrated in [Table 5](#).

(1) Bohai Sea: state-led paradigm shifts.

The evolution of Bohai Sea policy design follows a process of punctuated equilibrium, marked by a dramatic, top-down reconstruction that delineates two distinct paradigms. The initial policy design, represented by the Blue Sea Plan and the Environmental Protection Plan, was grounded in a linear, technology-centric causal theory: marine pollution was primarily caused by end-of-pipe discharges from key land-based industries and urban centers. This theory directly translated into clear, quantifiable engineering objectives. For example, the Blue Sea Plan required a reduction of over 10% in land-based COD emissions into the sea by 2005 compared to 2000, along with 20% reductions each for phosphates, inorganic nitrogen, and petroleum. The Environmental Protection Plan further refined this into a more sophisticated system covering four levels—regulatory constraints, process control, performance evaluation, and foundational capacity building—with nearly a hundred specific indicators. Despite the nominal clarity of these objectives, their institutional priority was fragile. Although formally approved by the State Council, these environmental objectives were systematically subordinate to the overarching agenda of rapid national economic growth. In the structural conflict between environmental protection and local economic development, policy objectives were often relegated to a secondary position. This gap between nominal priority and actual subordination limited the realization of ambitious engineering targets. As the Environmental Protection Plan noted, “the Blue Sea Plan was not completed on schedule and lacked systematicity.” Despite being technically detailed, this policy design was short of political authority to overcome the inherent structural resistance within its political-economic context.

The 2018 Campaign Plan diagnosed the environmental crisis as a systemic consequence of the decoupling among land, sea, and

TABLE 5 Differences in objectives and causal theory between Bohai and Seto Inland Seas' cases.

Case	Period	Objective	Causal theory
Bohai Sea (periodic, top-down reconstruction)	2001-2017	Controlling pollutant inflow (form over substance)	Linear causal theory
	After 2018	Improving ecosystem (substance over form)	Ecosystem-based causal theory
Seto Inland Sea (cumulative, adaptive evolution)	1960s-1970s	Controlling pollutant inflow (legal safeguard prioritization)	Linear causal theory
	1978-2012	Managing nutrient load of the entire ecosystem: TPLRS	Complex biogeochemical causal theory
	After 2012	Addressing oligotrophication through adaptive management	More complex, non-linear ecosystem theories

ecosystems. This new causal theory redefined policy objectives, shifting the focus from controlling pollutant inputs to improving the overall health of the ecosystem. For instance, the Campaign Plan set a target that by 2020, approximately 73% of coastal waters should meet the quality standards classified as good (Class I and II). The most critical innovation was the establishment of a prioritization mechanism. The policy was jointly issued by the Party and the highest state organs and was framed as a “campaign,” endowing it with indisputable enforcement authority. Therefore, it bridged the previous gap between nominal and actual priorities. The policy design combined extreme clarity—featuring four major actions, 18 specific tasks, and a precise timetable—with overwhelming political authority, creating a powerful mechanism aimed at achieving rapid and significant results.

(2) Seto Inland Sea: institutionalized learning and adaptation.

The policy design for the Seto Inland Sea evolved through an institutionalized process of learning and gradual adaptation, where scientific understanding and governance objectives co-evolved within a durable legal framework. The initial policy design, the 1973 Provisional Act, was a direct response to the severe socio-economic crisis known as the “dying sea.” Its causal theory followed a straightforward, linear model suited to the emergency situation: specific point sources of industry caused toxic pollution and red tides. Accordingly, the goal was singular and clear: to break this causal chain. As a law born from broad social consensus, the Provisional Act granted absolute, legally binding priority to environmental protection over development. This priority was implemented through strict licensing systems and development prohibitions. However, when initial approaches proved insufficient to curb red tides, scientific research revealed a more complex biogeochemical causal theory: nutrient inputs of nitrogen and phosphorus from agriculture, industry, and domestic sources across the entire basin were identified as the fundamental causes. This new understanding drove a shift in policy objectives from controlling specific pollutants to managing the nutrient load of the entire ecosystem. This shift was institutionalized through the Total Pollutant Load Reduction System (TPLRS), progressively incorporating COD, nitrogen, and phosphorus into total reduction targets. Furthermore, macro-objectives were decomposed into micro-level targets based on pollution sources, with specific tasks assigned to each coastal

prefectural implementing body. For example, the Ministry of the Environment’s Fifth Total Load Reduction Plan set a COD reduction target of 76 tons per day for Osaka Prefecture and 56 tons per day for Hyogo Prefecture. This approach greatly reduced ambiguity in policy implementation and effectively constrained opportunities for discretion and opportunistic behaviors.

The success in nutrient reduction led to the emergence of a new problem: oligotrophication. This prompted a shift in the causal theory toward more complex, non-linear ecosystem theories—namely the recognition that nutrient levels exist within an optimal range that maximizes ecosystem services (Yamamoto, 2003). This scientific breakthrough also spurred a change in policy objectives, evolving from simple reduction to more complex management and optimization. The 2021 revision of the Seto Inland Sea Act institutionalized adaptive management, authorizing bidirectional regulation of nutrient levels and establishing ecological restoration as a core priority. This evolution, driven by the institutionalized multi-stakeholder learning mechanism of the Central Environment Council, demonstrates the adaptability and resilience of the governance system.

5.2.2 Financial and technical resources

Fiscal and technical resources are not neutral inputs; rather, they serve as institutional vehicles that are deeply embedded within and reflect the underlying logic of the governance system. This section examines the resource supply models of the Bohai Sea and the Seto Inland Sea. The former is characterized by central government fiscal coordination and task-oriented technological innovations, aimed at ensuring the rapid achievement of national priorities through high-intensity, high-precision resource allocations. In contrast, the latter is marked by a legally embedded, diversified financing network and market-driven technological diffusion, aiming to stimulate the long-term vitality and innovation capacity of local actors and the private sector by creating a stable and predictable institutional environment. The main differences are presented in Table 6.

(1) Bohai Sea: campaign-driven allocation and task-oriented technology application.

The evolution of the resource mobilization model for Bohai Sea governance demonstrates a transition from funding shortfalls due

to decentralized responsibilities to central government-led fiscal mobilization. Prior to 2018, the resource allocation model adhered to the principle of “local-led with appropriate central support.” The Blue Sea Plan explicitly stated that investments in Bohai Sea pollution prevention and ecological construction were predominantly borne by local governments, assigning major financial responsibilities to the three coastal provinces and one municipality around the Bohai Sea. Whether it was the planned investment of 55.3 billion yuan in the Blue Sea Plan or the estimated 126.67 billion yuan in the Environmental Protection Plan, both relied heavily on local financial capacity, corporate investments, and uncertain market-based financing. This pattern led to persistent funding gaps and ineffective implementation. However, the Campaign Plan initiated a fundamental shift in the fiscal resource model. Its financial framework emphasized “central government guidance, local governments as primary actors, market operation, and social participation.” The policies explicitly called for “increasing central fiscal investment” and “integrating existing central fiscal funds related to marine ecological and environmental protection.” This represented a shift in the central government’s role from a supporter and guide to a direct integrator and allocator of resources. In practice, the system became a highly centralized, project-based top-down allocation mechanism, where local and market participation largely served as a response to and supplementary support for central directives. Compared to previous models, the scale and stability of funding have greatly guaranteed through direct injections from the central fiscal authority and dedicated coordination. The case of Liaoning Province exemplifies this change: in 2019, the central government allocated 600 million yuan from the Marine Ecological and Environmental Protection Fund, with the provincial government matching 500 million yuan. Together, they established a special fund of 1.1 billion yuan (Ministry of Finance of the People’s Republic of China, 2019). This fund was precisely distributed to specific coastal cities such as Dalian and Yingkou, earmarked for predefined projects, including sewage treatment facilities for rivers flowing into the sea, wetland restoration at estuaries, and the establishment of automatic monitoring stations. Additionally, the entire process is governed by a stringent performance management framework. The policy explicitly proposed “establishing an incentive and penalty mechanism for marine ecological protection benefits, and employing reward-instead-of-subsidy measures,” which linked the distribution of funds directly to local officials’ performance assessments and task completion. This approach transformed

fiscal resources from mere project funding into political leverage, motivating local governments to fully implement central policies.

The injection of technical resources into Bohai Sea governance follows a consistent logic. In terms of technical theory, governance adopted the principle of total pollutant load control. However, its implementation was more campaign-oriented, driven by strong national mobilization. Through massive investments, the system promoted the comprehensive upgrading of wastewater treatment plants, rapidly popularized standardized technologies represented by the A²/O process, and achieved extensive control over key pollutants within a relatively short period (Wang et al., 2019). At the level of applied innovation, the technical system was reshaped into a tool that serves powerful regulation. The most representative example of this shift is the “investigation, monitoring, source tracing, and remediation” system for marine outfall inspection. This system utilizes advanced technologies such as UAV aerial photography, infrared remote sensing, underwater robotics, and water sample isotope tracing to conduct a comprehensive “net-casting” investigation of all land-based outfalls, enabling precise localization of pollution sources and accountability (Qiao et al., 2021). Therefore, the Bohai Sea’s fiscal and technical resource system functions as an efficient and precise instrument of state power. Its vitality and sustainability, however, largely depend on the continuation of the high-level political agenda that originally drove its creation.

(2) Seto Inland Sea: networked finance and market-enabling technology ecosystem.

The Seto Inland Sea has established a permanent, multi-level, and legally anchored financial ecosystem designed to ensure long-term institutional resilience, regional autonomy, and adaptive learning capacity. This financial ecosystem is supported by three major institutional pillars. The first pillar is the legally enforced Polluter Pays Principle. The Act on the Burden of Pollution Prevention Project Costs on Business Operators transformed the “polluter pays” principle into a strict legal obligation. It explicitly stipulates that enterprises causing pollution must bear all or part of the costs for “pollution prevention projects” (such as river dredging, sewage system construction, etc.) based on their pollution contribution. This framework has a dual effect: it provides a continuous source of funding for governance, while simultaneously creating a strong reverse incentive, economically compelling enterprises to invest in source reduction technologies, thereby fundamentally reducing pollutant loads. The second pillar is institutionalized public finance. Based on the Sewerage Act (Act No. 79 of 1958), and further specified by its subordinate legislation, the Order for Enforcement of the Sewerage Act (Cabinet Order No. 147 of 1959), a precise national financial sharing mechanism was established. Article 24–2 of this Enforcement Order legally creates a differentiated incentive matrix. Firstly, it establishes a universal financial guarantee, stipulating that the state provides a baseline subsidy of 50% for local governments constructing core public sewerage facilities (e.g., pipes, treatment plants). More critically, it embeds a strategic incentive tool, authorizing the Minister of Land, Infrastructure, Transport and Tourism to increase the subsidy rate to 55% for specific facilities of terminal treatment plants that meet

TABLE 6 Differences in financial and technical resources between Bohai and Seto Inland Seas’ cases.

Case	Financial resources	Technical resources
Bohai Sea	Central government fiscal coordination	Task-oriented technology application
Seto Inland Sea	Diverse financing network	Market-driven technology diffusion

certain policy objectives (e.g., combating eutrophication). Furthermore, for basin sewer projects aimed at achieving cross-regional integrated governance, subsidies for key facilities can cover up to two-thirds of costs. This differentiated fiscal incentive mechanism ensures a stable funding supply for the continuous construction and upgrading of critical infrastructure such as large-scale wastewater treatment plants. The third pillar is a flexible public-private partnership fund. Managed by civic organizations such as the Association for the Environmental Conservation of the Seto Inland Sea, the Seto Inland Sea Fund is financed through voluntary donations from businesses and individuals, along with partial government subsidies. These funds primarily support “soft” projects that are difficult to cover through traditional government finance, such as environmental education, citizen science monitoring, small-scale ecological restoration pilots, and cross-boundary collaborative research. This fund has become an indispensable accelerator of social learning within the governance system, providing critical support for adaptive management and the incubation of innovative solutions.

This tripartite framework is operationalized through a multi-sectoral, project-based funding matrix governed by the Seto Inland Sea Act and its Seto Inland Sea Environmental Conservation Basic Plan. Coastal prefectural and municipal governments can proactively apply for and assemble customized funding packages from a programmatic funding matrix tailored to local needs. This financing system is jointly supported by several central ministries, including the Ministry of Land, Infrastructure, Transport and Tourism (responsible for sewage systems, marine pollution prevention, and related projects), the Ministry of the Environment (handling water quality monitoring, biodiversity conservation, and other initiatives), and the Ministry of Agriculture, Forestry and Fisheries (overseeing red tide control and fishery restoration efforts). Local budgets and private foundations, such as the Japan Maritime Science Foundation, also contribute to this effort (Ministry of the Environment, 2018a, 2018b). This networked institutional arrangement not only ensures the long-term stability of funding sources but also grants local actors substantial autonomy and flexibility, thereby fostering a problem-solving-oriented, resilient, and dynamic fiscal ecosystem.

The technological system in the Seto Inland Sea follows a service-oriented, market-enabling model for technology validation and dissemination. Japan has undertaken more profound and diversified explorations in technology research and development. In the field of biological nitrogen removal, Japan has developed and applied advanced processes such as nitrification-endogenous denitrification, staged influent nitrification-denitrification, and the

Anammox process. In phosphorus removal, Japan has utilized various physico-chemical technologies capable of resource recovery, such as calcium phosphate or struvite precipitation methods and the Heatphos process. More critically, Japan’s technology diffusion mechanism is embodied by the Environmental Technology Verification (ETV) program, managed by the Ministry of the Environment. This program does not guide R&D but serves as an impartial third-party verifier of the performance of environmental technologies in their commercialized state. For instance, technologies such as improving bottom sediment with steel slag or promoting large-scale seaweed growth by supplying iron have been validated and promoted through the ETV program. By providing reliable information to the market, the ETV program empowers a demand-driven, bottom-up approach to technology adoption, fostering a vibrant ecosystem of technological innovation and dissemination.

5.3 Implementation arena

5.3.1 Implementation structure

The implementation structure is the institutional hub that translates policy intentions into tangible outcomes, fundamentally determining the efficiency, resilience, and legitimacy of governance models. The core finding of this section is that the Bohai Sea’s implementation structure functions as a mobilizational command system, characterized by achieving temporary, highly vertical integration through strong political pressure during specific periods. However, this approach often leads to implementation deviations. In contrast, the Seto Inland Sea adopts an institutionalized deliberative network, which facilitates continuous inter-agency coordination and social collaboration through multi-stakeholder participatory mechanisms. This approach ensures governance adaptability and sustainability. The main differences are shown in Table 7.

(1) Bohai Sea: top-down integration, strategic compliance, generalist cadres, and supervisory participation.

During the period dominated by the Blue Sea Plan and the Environmental Protection Plan, there were significant institutional veto points and implementation difficulties, with problems related to hierarchical integration being fully exposed. A horizontal veto point appeared in the form of inter-departmental conflicts within a “nine dragons managing the waters” scenario. The pattern of over ten departments “each performing their own duties” essentially evolved into a battlefield of competing departmental interests,

TABLE 7 Differences in implementation structure between Bohai and Seto Inland Seas’ cases.

Case	Hierarchical integration	Decision rules	Official recruitment	Formal access by outsiders
Bohai Sea	Overcoming structural veto points through political mobilization	Strategic compliance	Generalist cadres	Supervisory participation
Seto Inland Sea	Dissolving veto points through institutionalized deliberation	Science-driven and adaptive discretion	Permanent professional bureaucrats	Empowered partnerships

where environmental departments' plans were often diluted by departments with greater developmental authority. The official approval document for the Blue Sea Plan, issued by the State Council in 2001, explicitly revealed this highly fragmented governance structure, requiring more than ten agencies—including the State Development Planning Commission, State Economic and Trade Commission, Ministry of Science and Technology, Ministry of Construction, Ministry of Communications, Ministry of Water Resources, Ministry of Agriculture, State Forestry Administration, State Oceanic Administration, and even the environmental protection departments within the military—to diligently fulfill their responsibilities according to their respective functional divisions. However, in the specific implementation process, due to the intricate interests among local governments and various marine-related departments, each department pursued its own policy agenda. When these agendas conflicted with environmental goals, the absence of a super-ministerial coordinating body with absolute authority resulted in each department potentially using its prerogative to veto environmental measures. The relationship between central and local governments constituted an even more fundamental vertical veto point. In a political tournament centered on economic growth, local governments tended to prioritize their economic interests and possessed strong “soft veto power” against central environmental directives. As a result, they responded to environmental tasks through selective or symbolic implementation, causing the central policy intentions to dissipate significantly during top-down transmission (Tian and Zheng, 2020). Although the approval of the Blue Sea Plan mandated integrating goals into the target responsibility systems for provincial, municipal, and county heads, this requirement largely remained superficial due to the lack of strong constraints and sanction mechanisms.

The Campaign Plan ushered in a radical transformation of the hierarchical integration model. Its success did not stem from the institutional eradication of the aforementioned veto points, but rather from temporarily suppressing all veto points through a campaign-style governance mode, employing what Sabatier described as “sufficiently great inducements and sanctions.” The core mechanism during this phase is the CEEPI, which pierces through vertical veto points with its inspection authority and integrates horizontal veto points through political mobilization. By decentralizing inspections and enforcing stringent accountability, the CEEPI mechanism elevates environmental issues from routine administrative tasks to a core agenda tightly tied to local officials' political responsibilities, thereby directly overcoming their “soft veto power.” For example, this included the feedback from the 2019 “review and follow-up” inspections in the three provinces and one municipality of the Bohai Sea region, the public disclosure of accountability for special inspections, and the Party disciplinary and administrative sanctions against responsible officials (Department of Ecology and Environment of Liaoning Province, 2019). This authoritative affirmation from the central government, coupled with rigorous accountability procedures, completely altered local governments' cost-benefit calculations, making the enforcement of environmental directives

the only rational choice. Under the immense pressure of CEEPI, past horizontal departmental barriers were also temporarily broken. The Ministry of Ecology and Environment was endowed with unprecedented coordination and supervision powers, enabling it to initiate cross-departmental and cross-regional special actions that were previously difficult to push forward, such as the 2019 investigation of marine outfalls in Bohai coastal cities, which mobilized thousands of personnel (Ministry of Ecology and Environment of the People's Republic of China, 2019). This effort achieved highly efficient horizontal integration among different departments at the action level.

The decision-making rules of local implementing agencies tend to devolve from scientifically precise governance into strategic compliance under intense political pressure. The primary goal of their decisions is to smoothly pass inspections and avoid accountability, which clearly reveals the mechanisms behind implementation deviations, such as “one-size-fits-all” approaches. Under a pressure-driven system, local officials face a dual dilemma: information asymmetry between central and local governments and a promotion tournament. When higher authorities assign environmental tasks with tight deadlines, heavy workloads, and high standards, local officials are inclined to adopt a self-protective strategy to circumvent the enormous political risks associated with being held accountable. The “one-size-fits-all” approach is an extreme manifestation of this strategy: while crude, imprecise, and potentially even detrimental to the economy and livelihoods, it is the compliance method with the lowest information cost, fastest implementation speed, and clearest political stance (Liu, 2024; Wang and Zhou, 2021). It sends a strong signal to inspection teams that local governments are “uncompromisingly” executing central directives. Therefore, this seemingly irrational decision-making process is, in fact, a rational choice made by local officials to seek political security within a specific institutional environment.

The main executors of the Bohai Sea governance campaign are China's generalist political cadres, whose career advancement and political promotion are profoundly influenced by the cadre evaluation system. The formidable power of the CEEPI mechanism lies in its direct linkage of environmental performance with the political accountability of key local party and government leaders. This means that the success or failure of environmental protection tasks is not merely a technical or administrative issue but is also seen as a test of loyalty to central authority and political commitment. This political loyalty-centered cadre incentive mechanism can, on one hand, generate strong mobilization capacity to ensure the implementation of central directives; but on the other hand, it also reinforces officials' motives to adopt “one-size-fits-all” short-term and superficial measures to “pass” evaluations, thereby neglecting the long-term and scientific nature of governance.

With regard to formal access by outsiders, the governance framework of the Bohai Sea provides avenues for external actors to participate, but this participation takes the form of bottom-up supervision. The CEEPI encourages and heavily relies on the public to report violations via hotlines, websites, and other channels. The strategic value of this participation lies in its ability to effectively

break the monopoly of information held by local governments, enabling the central government to access frontline information that local officials might conceal or gloss over. However, this form of participation is primarily informational and supervisory in nature. As a result, the public is not integrated into the decision-making process as equal governance partners; instead, they function as an important informational channel that enhances the central government's capacity for vertical accountability. They are unable to participate in core decision-making stages, such as setting policy goals, drafting rectification plans, or evaluating governance outcomes.

The integrity of the implementation structure is ultimately realized through the manner in which the judiciary collaborates with administrative objectives, thereby forming a unified national governance capacity. In China, the judiciary's role in environmental governance is best understood as a system-integrated judicial function that safeguards the coherence of national governance and the alignment with central policy implementation. When issues identified by CEEPI are escalated to judicial proceedings, the courts' core function is to deploy legal instruments efficiently to ensure that penalties imposed on polluting enterprises and on derelict local officials are duly enforced, thus providing the indispensable legal finality and enforceability for an administrative-led accountability regime. Consequently, the judiciary completes the internal loop of the vertical accountability system, ensuring the integrity and efficiency of the power chain from political decision-making to ultimate execution.

(2) Seto Inland Sea: institutionalized integration, science-driven deliberation, professional bureaucrats, and empowered partnerships.

The hierarchical integration of Seto Inland Sea governance exemplifies a decentralized, networked model rooted in law, centered on deliberation, and characterized by broad multi-stakeholder participation. This model transforms potential veto points into participants in negotiations through institutionalized procedures, contributing to long-term, stable policy integration. Firstly, the Seto Inland Sea Act serves as the cornerstone of the entire governance system and the framework for vertical integration. Article 4 explicitly stipulates that the central government (the Minister of the Environment) is responsible for formulating the macro-level basic plans for environmental conservation, while the 13 relevant prefectures have a legal obligation to formulate and implement more specific prefectural plans based on the basic plan and local circumstances. This "central framework setting, local detailed implementation" model ensures vertical alignment between national goals and local actions at the legal level, providing the highest level of legitimacy and directional guidance for all subsequent governance activities. Secondly, this top-level design creates institutional space for a vibrant, networked governance system to take root and flourish at the local level. At this tier, the integration model manifests as a public-private collaborative network. Guided by the Ministry of the Environment, the local government is redefined as enablers and coordinators, tasked with establishing platforms such as the Promotion Councils to organize diverse social forces. As shown in the minutes of the Kagawa Prefectural Assembly meetings, local

governments allocated budgets to support FCAs in projects for restoring seaweed beds and tidal flats (Kagawa Prefecture Assembly, 2022). This approach not only efficiently leverages valuable local knowledge but also stimulates community autonomy, forming a resilient, bottom-up governance network. Finally, the institutionalized deliberative mechanism serves as a systemic stabilizer for managing and resolving conflicts of diverse interests, ensuring a dynamic balance between vertical objectives and horizontal networks. Various deliberative councils, particularly the Seto Inland Sea Subcommittee of the Central Environment Council, are key platforms for managing potential veto points. Their membership composition is highly representative: scientists from top universities and national research institutions ensure the scientific rigor of decisions; the participation of key stakeholders, such as the president of the Shikoku Economic Federation and the managing director of the national federation of FCAs, incorporates potential veto powers into the negotiation process in advance; and the involvement of heads of environmental departments from relevant prefectural local governments forms a crucial information feedback loop. This diverse, open, and professional deliberative arena internalizes potential conflicts early on, transforming disagreements into consensus-building processes through repeated review and dialogue, thereby bridging the gap between macro-level policies and micro-level practices.

The decision-making rules of implementing agencies are grounded within a legal framework, based on adaptive discretion that combines scientific rigor and deliberative negotiation. The primary basis for their decisions is the Seto Inland Sea Act and its basic plan, which are dynamically adjusted through scientific monitoring and social consultation. Every revision of the basic plan must undergo rigorous argumentation by review councils, ensuring the scientific foundation of the decisions. More importantly, this legal framework does not pursue a "one-size-fits-all" uniformity; instead, it encourages local governments, under the guidance of overall goals, to develop innovative solutions based on their unique local ecological and socio-economic conditions. The core of this decision-making rule is not to showcase resolve in execution to higher authorities, but to solve actual environmental problems on the ground. Its legitimacy derives from procedural justice, scientific rigor, and tangible outcomes.

The implementation entity is a complex network comprising expert bureaucrats, local government officials, scientists, corporate representatives, and citizens. While elected officials, such as prefectural governors and mayors, bear ultimate responsibility, the actual governance work is largely driven by permanent professional bureaucrats within the Ministry of the Environment and local government environmental departments. Their career progression depends more on specialized expertise and long-term, stable policy implementation capabilities. More importantly, the institutionalized deliberative councils and agreement bodies make external experts and stakeholders—such as scientists, industry representatives, and fishermen—indispensable quasi-officials within the implementation network, fostering a situation of collective responsibility and co-governance.

A key feature of external actors' participation is their institutionalized engagement combined with functional empowerment. This participation is not a passive consultation or a top-down mobilization; rather, it is embedded in the governance structure by laws and institutions, becoming an endogenous and indispensable component of co-governance. The Seto Inland Sea Environmental Conservation Council, established under the Seto Inland Sea Act, serves as the highest-level institutional guarantee. This council obligatorily includes key officials from relevant central ministries, governors of the 13 related prefectures, mayors of major cities, and representatives from academia, industry, and civil society organizations, all within a unified decision-making platform. This design ensures that cross-level (central-local) and cross-sector (government-society) stakeholders can engage in continuous, structured negotiation and deliberation within a legally mandated framework. The decisions made by this council have binding legal effects on the government's Environmental Conservation Basic Plan, effectively transforming external participation from mere opinion expression into a process that actively shapes policy decisions. Functional empowerment is most profoundly embodied in the long-established FCAs, which form the institutional cornerstone of bottom-up governance. Through laws such as the "Fisheries Act," the state grants FCAs exclusive fishing rights, transforming them from interest groups into co-managers of resources with micro-regulatory powers (e.g., setting fishing gear specifications and catch limits). More critically, as the economic hubs of their communities, the organizations' interests are institutionally bundled with the long-term sustainability of resources, thereby effectively overcoming the collective action problem inherent in common-pool resource governance (Zhao, 2012). Therefore, the participation of FCAs is not symbolic but is based on their statutory management rights and internalized economic interests, which enables them to act as substantive actors within the governance network.

The Seto Inland Sea's implementation structure exhibits resilience that is eventually realized in the judiciary's function as an independent arbiter, profoundly shaping the balance of power among the state, industry, and civil society. In Japan, the judiciary's role in environmental governance is more aptly described as a social-empowering judiciary, whose core function is to establish a solid legal foundation for public participation and corporate accountability. This role was crystallized in landmark rulings from the era of the Four Major Pollution-Related Diseases: when pollution-related environmental litigation initiated by citizens enters the judicial process, the court's central task is to render independent judgments on the rights claims between citizens and polluting enterprises. By imposing strict liability on enterprises and recognizing citizens' environmental rights, the judiciary furnishes society with robust legal remedies to counterbalance the influence of strong industrial interests and administrative authorities. As a result, the judiciary provides an indispensable legal cornerstone for the governance system's openness, and all collaborative governance frameworks—grounded in deliberation, checks and balances, and power-sharing—are anchored on this foundation.

5.3.2 Key actors' roles and commitment

The commitments of officials, media attention, and public support collectively constitute the soft power of the governance system, influencing both the social legitimacy and long-term resilience of policy implementation. This section demonstrates that the Bohai Sea has established a transactional system of responsiveness, characterized by task-driven official commitments, media engagement under state mobilization, and channelized public oversight. In contrast, the Seto Inland Sea has cultivated a relational ecosystem of co-production, centered on consultation-driven official leadership, media participation driven by identity recognition, and community-oriented public management. These differences are illustrated in Table 8.

(1) Bohai Sea: transactional commitments and channelized public oversight.

Within the Bohai Sea governance framework, the commitments and roles of key actors are rigorously integrated into a top-down, closed-loop system focused on achieving political tasks. First, the commitments of officials manifest as transactional responsiveness; their leadership is characterized not by consensus-building but by the ability to efficiently implement central directives and handle reported issues. For example, the grid-based environmental regulation model implemented in certain regions places local officials within a clearly defined, hierarchical system of responsibility, where their core duty is to respond swiftly and resolve public complaints collected through channels such as the "12369" environmental hotline. This commitment is grounded in administrative accountability, with its strength directly tied to pressure from high-level political agendas. Second, public support is procedurally transformed into a channelized oversight mechanism. The Ministry of Ecology and Environment's Administrative Measures for Environmental Protection Reporting Hotline clearly defines public participation primarily as reporting illegal activities, rather than engaging in decision-making (Ministry of Ecology and Environment of the People's Republic of China, 2021). Lastly, the media functions as a vital tool for state communication and mobilization, amplifying policy signals and guiding social perception of governance actions. Official media reports tend to frame public channels as effective auxiliary mechanisms for government oversight and actively encourage their use among the public.

TABLE 8 Differences in key actors' roles and commitment between Bohai and Seto Inland Seas' cases.

Case	Official commitment & leadership	Media attention	Public support
Bohai Sea	Transactional; mission-driven responsiveness	Engagement under state mobilization	Channelized public oversight
Seto Inland Sea	Relational; consensus-driven commitment	Engagement by identity recognition	Community-based co-management

(2) The Seto Inland Sea: relational commitment and community-based co-management.

The actor system in the Seto Inland Sea is a relational network built on deep social trust and cultural identity, where commitments are endogenous and enduring. First, the commitments of officials take the form of consensus-enabling leadership. Local officials' core task is to foster ongoing dialogue, listen to and integrate the opinions of diverse stakeholders, and collaboratively develop and adjust local environmental policies. Their success is measured not merely by enforcing directives from higher authorities, but by facilitating consensus among local stakeholders and supporting their autonomous governance activities. This commitment aims to establish long-term partnership relations. Second, public support evolves into a form of co-management based on cultural identity. Rather than being driven solely by a reporting system, this support stems from a profound collective sentiment encapsulated by "Our Sea." The media plays a crucial role as a cultural constructor. Through continuous in-depth reporting and seminars, it not only exposes pollution issues but also systematically constructs and disseminates the core concept of "Satoumi," which closely links marine health with community well-being and cultural heritage. This fosters an internalized sense of civic responsibility, making citizens proud to safeguard their common homeland. Finally, this shared commitment to co-management is most vividly realized within community organizations such as FCAs. As mentioned earlier, FCAs are not just interest representatives but also legally empowered resource managers and rule-makers. Their commitment is direct and vital for their survival, as the health of the ocean directly affects their livelihoods and future prospects. Embedded deeply within community economic life and cultural practices, this commitment provides the most solid and sustainable social foundation for adaptive governance in the Seto Inland Sea.

6 Conclusion

This study systematically compares the pollution governance mechanisms of the Bohai Sea and the Seto Inland Sea by using a reconstructed S-M policy implementation model. The findings reveal that the Bohai Sea's governance model operates within an authoritarian, development-oriented political-economic context, where the strong intervention of high-level political agendas temporarily integrates a fragmented governance landscape. Its implementation structure centers on vertical political accountability, with resource mobilization characterized by campaign-driven approaches, and public participation channelized into a bottom-up supervision mechanism. The advantages of this model lie in its formidable mobilization capacity and efficiency in goal achievement, enabling rapid concentration of efforts to address critical and urgent environmental issues, thereby demonstrating the state's resolve and capability in responding to major challenges. Conversely, the Seto Inland Sea's governance model operates within a pluralistic, negotiated institutional environment and establishes a permanent, networked governance ecosystem through a landmark specialized

law. Its implementation structure features horizontal, multi-stakeholder institutionalized deliberation, where fiscal and technical resources are stably supplied within a predictable legal framework, and public and stakeholder participation are deeply embedded as empowered co-governance partners in the decision-making process. The strengths of this approach lie in its resilience, adaptability, and intrinsic learning capacity, enabling dynamic adjustments to governance goals in response to emerging challenges through continuous social dialogue and scientific assessment, thus achieving sustainable environmental governance.

The findings of this study have profound implications for marine environmental governance in China and globally. Both models possess inherent rationality and strengths within their specific historical contexts. The future challenge lies in transcending binary choices and exploring a hybrid governance pathway that integrates the advantages of both, fostering more effective and adaptive marine governance.

First, marine environmental governance needs to explore institutional innovations to transition from campaign-style initiatives to regularized, sustainable governance practices. The successful experience of Bohai Sea governance demonstrates that high-level political impetus is crucial to breaking stalemates and achieving breakthrough progress. Moving forward, efforts should focus on transforming effective mechanisms established during campaign-driven governance (such as strict accountability systems and cross-departmental coordination platforms) into regularized, legally backed institutional arrangements. This will help avoid the risk of the familiar cycle: "when the campaign ends, problems resurface." To achieve this, a comprehensive law specifically for the Bohai Sea, similar to the "Seto Inland Sea Act," is needed to provide a solid legal foundation for long-term governance.

Second, it is essential to construct a hybrid resource and implementation system that combines efficiency with resilience. The marine environmental governance system can explore a "dual-track" resource allocation model: on the one hand, retaining the central government's capacity for strategic, large-scale investment at critical moments to address urgent or major environmental challenges; on the other hand, clarifying, through legislation, the long-term investment responsibilities and incentive mechanisms for local governments, enterprises, and society, thereby fostering a vibrant and diversified ecosystem for financing and technological innovation.

Third, public participation should be deepened, transforming it from mere oversight into a true co-governance partnership. While maintaining public supervision as an effective channel, greater efforts should be made to explore how to empower relevant stakeholders through functional empowerment, thus transforming interest groups intrinsically linked to the health of the ocean into true stewards of resource management. More institutionalized deliberative platforms should be gradually established to incorporate diverse stakeholders—including research institutions, enterprises, environmental organizations, and community representatives—to substantively participate in the formulation of marine environmental goals, as well as in the evaluation and adjustment of governance strategies.

Beyond these specific policy pathways, the comparative insights of this study point toward a more fundamental conclusion regarding the future of global marine stewardship. The challenges confronting semi-enclosed seas are seldom confined by national borders, demanding not only robust domestic actions but also a shared vision for international collaboration. It is at this intersection of national capacity and global aspiration that our findings make a paramount contribution.

Ultimately, the findings of this study provide a solid foundation from the perspective of governance science for understanding the global vision of a “Maritime Community with a Shared Future.” The realization of this grand vision transcends mere international political declarations or diplomatic agreements. Its true bedrock lies in the capacity of each nation to successfully forge an effective and adaptive domestic marine governance system. The Bohai Sea’s governance practice represents a profound attempt by China to construct a regional environmental community with a shared future internally—integrating fragmented regional interests through strong central authority to achieve a unified and sustainable ecological future. Through an in-depth dissection of this domestic governance model, this study reveals the difficult choices and diverse possibilities for institutional innovation required to build such systems. Only on this foundation can cooperation between nations find the solid domestic institutional support necessary to collectively advance toward a healthy, prosperous, and sustainable blue future.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Author contributions

MY: Formal Analysis, Writing – review & editing, Conceptualization, Writing – original draft. RG: Formal Analysis, Writing – review & editing.

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