

Article

The Regime Complexes for Global Climate Governance

Lihua Zhang * and Erhai Bai

School of Public Administration, Jilin University, Changchun 130015, China; baieh22@mails.jlu.edu.cn

* Correspondence: z_lh@jlu.edu.cn

Abstract: Climate change is a major challenge for human society in the 21st century and an important issue in the context of sustainable development governance. As the density of institutions in global climate governance increases, so does the potential for overlap and interaction between the various elements of institutions. The current global climate governance issue is no longer solely a state-centric governance model but presents a complex manifestation of a complex of mechanisms. Taking a global climate governance perspective, this paper finds that the institutional complex of global climate governance is shaped by internal factors, such as self-attribution, rights, and interest linkages. External factors include the rapid development of globalization and the non-governmental state of the international community. The internal logic of the institutional complex is based on the institutional fragmentation of multiple interested parties involved in the governance process and the interaction patterns of internal actors. The institutional complex of global climate governance has the following implications for policy-making: the strength of the institutional complex refers to the framework of decision-making; the flexibility of the arguments provides stakeholders with demands related to their interests and inspires different countries to join in the governance of global climate change.

Keywords: global climate governance corporate; social responsibility and sustainability; information systems operations management impact analysis; mechanism complex; institutional fragmentation

1. Introduction

Today, the international community is faced with many challenges. More and more international affairs require global cooperation and governance, especially in the field of environmental issues and climate change, which runs counter to the concept of sustainability. Climate change is a major challenge facing human society in the 21st century and an important topic for global governance [1,2].

Figure 1 shows the change in global average temperature over the last 150 years from 1860 to 2000 [3]. As can be seen from the graph, the recent trend in average temperature change shows a much steeper rate of increase. This indicates that global average temperatures are rising at an unprecedented rate in the 100-year history of temperature change. The impacts of global warming on human society and the planet's home are both beneficial and detrimental [4]. The global glaciers are melting at an accelerated rate as a result of warmer temperatures, and the two levels of melting ice and expanding seawater caused by global warming will endanger coastal areas around the world, with many small maritime nations now suffering from widespread seawater intrusion. Warming has a direct impact on human health, with heat-related morbidity rates and mortality rates increasing as the number and extent of heat waves continue to rise [5,6]. Especially in the poorer, most vulnerable developing countries, people in these countries and regions face water and food shortages and greater health risks due to a lack of social and technological resources and funding for adaptation. Similarly, in our national climate change assessments published over the years, it is clear that the impacts of climate change that have been observed are significant and multifaceted. There are both favorable and unfavorable impacts in all areas and regions, with adverse impacts dominating [7,8].



Citation: Zhang, L.; Bai, E. The Regime Complexes for Global Climate Governance. *Sustainability* **2023**, *15*, 9077. <https://doi.org/10.3390/su15119077>

Academic Editor: Harris Wu

Received: 13 April 2023

Revised: 24 May 2023

Accepted: 31 May 2023

Published: 4 June 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

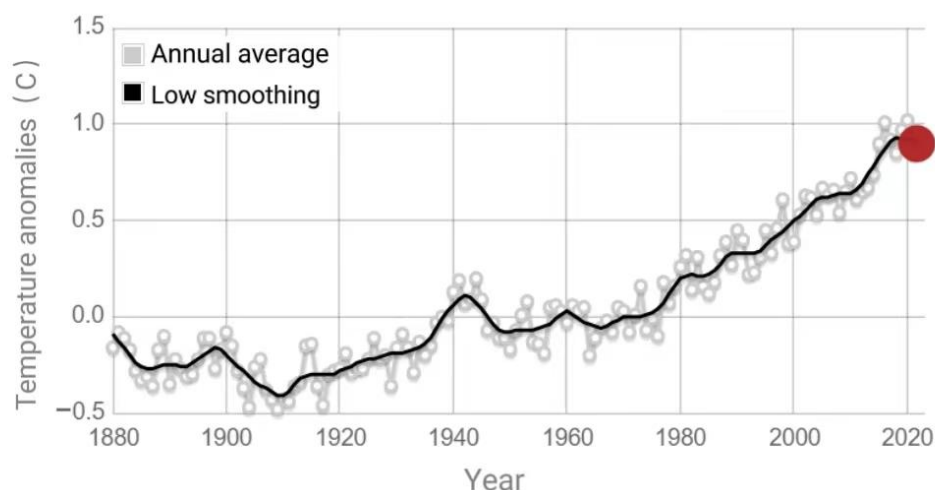


Figure 1. Changes in global mean temperature over the last 150 years from 1860 to 2000.

Since Copenhagen in 2009, global climate governance has gradually shifted from a negotiation-driven to a practice-driven paradigm, including a diverse set of actors and multi-dimensional institutions. The globalization of climate governance has fragmented towards its members or specific elements, with countries referring to institutions that have diversified over time [9,10]. Thus, discussion on the institutional complex of global climate governance requires attention in a regime of fragmented interests, high uncertainty, and interactive change. Their scale, impact, and scope pose serious challenges to human society. How to respond more effectively to climate change is a major strategic issue involving both national self-interest and the common interests of all humankind, and both immediate and long-term interests [11,12]. According to the 30-year historical evolution of global climate governance, there are four main challenges: insufficient emission reductions, leadership deficit, imperfect governance institutions, and increased uncertainty and instability in the international environment [13,14].

The mechanism complex is an emerging cross-research hotspot in the field of institutional research and global governance research, which profoundly points out the current situation of global governance at the mechanism level and also puts forward a contemporary proposition for theoretical research. Climate governance, as an important aspect of global governance, has also emerged as a situation of overlapping and nested governance mechanisms in its real development. The development of global climate governance, as the core approach to address global climate change, has a bearing on the future fate of human development and should be given attention and care in research. Therefore, the main contributions of this paper are:

1. To analyze the reasons for the emergence of the mechanism complex in the field of global climate governance, the logic of its development and its impact, and the practical and theoretical aspects; the answers to these questions are also the purpose of this paper.
2. Most of the current studies on global climate governance focus on the ethics and morality of different actors in responding to climate change, the effectiveness of existing mechanisms in responding to climate change, and the game between countries in a certain issue, but less on the climate change governance mechanism itself.
3. The existing studies on mechanism complexes in the field of climate governance are mostly focused on the micro level, preferring quantitative research methods, and seldom form generalized inductive conclusions about the causes and development logic of mechanism complexes. Therefore, the innovation of this paper lies in both the topic selection and the research method, i.e., it focuses on the changes in climate governance at the mechanism level and tries to answer the corresponding research questions with a qualitative research method.

Under the situation of unprecedented changes in a century, the green recovery of countries needs to establish a more effective cooperation mechanism at the global level to achieve low-carbon transition and technical, economic, and industrial cooperation in global climate governance [15,16]. China should proactively strengthen international cooperation in climate governance: first, it should actively assume the responsibility of a major power to promote global green and low-carbon development and promote the construction of a more equitable and reasonable international cooperation mechanism; second, it should build a tripartite private sector cooperation pattern between China, the United States, and Europe, and strengthen the international exchange of green and low-carbon technologies and industries (the cooperation mechanism at the official level between China, the United States, and Europe is already in place, but the overall progress is rather slow, for which we need the help of the second-track private sector cooperation mechanism to promote and strengthen the international exchange and cooperation of green low-carbon technologies and industries); third, we should promote regional cooperation in addressing climate change, and especially strengthen cooperation with developing countries along the Silk Road in climate governance and low-carbon transition [17,18].

2. Literature Review

2.1. *The Theory of Mechanism Complexes in Global Climate Governance Mechanisms*

For scholars, the institutionalism encompassed by political science refers to three main types, namely sociological institutionalism, historical institutionalism, and rational choice institutionalism. By institutionalism, we mean a more defined way of activity or the integration of structures [19]. Government, for example, was a form of politics that has been institutionalized. Previous institutional studies have focused on analyses at the level of political parties, court mechanisms, and parliaments and have generally focused on formalized institutions. Late in the last century, institutionalism began to shift the meaning of institutions from rules to ideas, capital, and regulation. The issues that institutionalism sought to address are the properties of institutions and how they affect specific human behavior. The questions raised by institutionalism relate mainly to the field of social science, including how structures, organizations, ethos, culture, and regulations produce social behavior, how power is configured within actors, and how they affect individual decision-making mechanisms and their outcomes. Because of the outstanding breadth of the meaning of institutions, institutionalism, which concerns almost all areas of social science, is also linked to the political, economic, ideological, and social spheres [20–22].

International mechanisms are a set of explicit or implicit principles, norms, rules, and decision-making procedures that are brought together by the expectations of actors in a particular field of international relations. Actors surround them with phenomena that generate mutual expectations. By ‘actors’ in this context, we mean subjects that produce a set of behaviors in international relations in various governmental and non-governmental sectors [23]. They are not only the subjects who propose the mechanisms but also the subjects who are bound by them. The principles involved in the mechanisms reflect the ideas of the actors and their beliefs. Regulations refer to the paradigms of behavior defined using rights and obligations. Rules refer to specific prohibitions on certain behavior. Decision-making processes refer to the habitual behavior of deciding and implementing the same policies.

The theory of the mechanism complex has developed rapidly over the past decade, but its conceptual scope has so far not formed a relatively unanimous understanding in the domestic and international academic community, leaving the understanding of the concepts and theories related to the mechanism complex in a rather messy state. The traditional international mechanism defined the international mechanism as a single object of study, from the formation stage of the international mechanism, the operation stage, and the important role it played in international cooperation, etc., all of which were elements of great concern to the traditional international system. However, in recent years, influenced by the proliferation of international regimes and the increased density of regimes in related

issue areas, scholars have come to recognize that international regimes are not created in a vacuum, nor can they develop in isolation, and have argued that there is an overlap and complementarity between institutional arrangements in specific issue areas. Thus, an understanding of governance in a particular issue area must focus on the interactions between relevant mechanisms in that area [24].

The climate change issue area consists of a complex of mechanisms. There is no hierarchy in climate governance and a loose set of climate change mechanisms each plays its proper role. The most current research on the complex climate change mechanisms comes from Kenneth Abbott. Keohane brought together the complex governance mechanisms of the current climate change response within a holistic governance context and has given it the concept and connotation of a ‘climate change regime complex’. Figure 2 shows that this complex of mechanisms includes the climate mechanisms within the UN framework, such as the Convention and the Kyoto Protocol, the specialized agencies within the UN framework, such as the UN Environment Programme and the UN Development Programme, as well as various bilateral and multilateral framework agreements and governance platforms [25]. The inside of the circle represents the main climate rule-making or implementation mechanisms at the moment, while the outside of the circle mainly refers to the supporting mechanisms attached to rule-making. According to Keohane, no single mechanism can be the absolute authority, and it is still unclear which will gain more power.

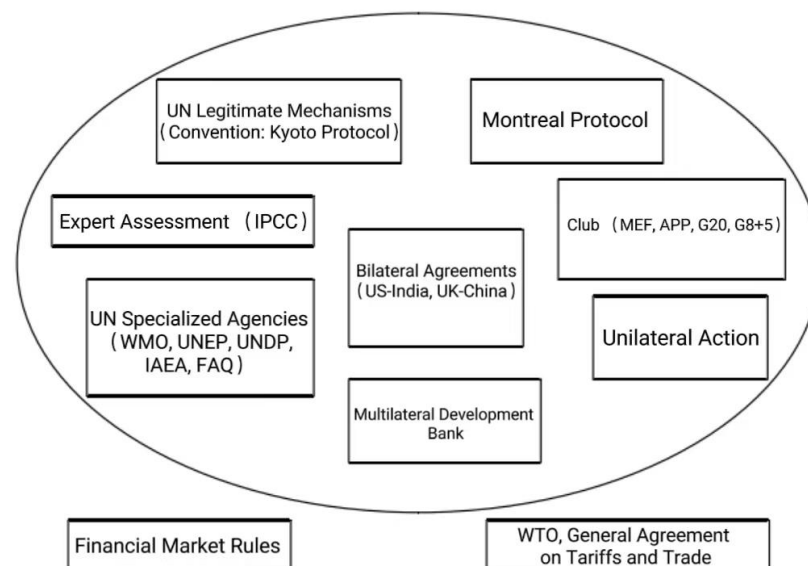


Figure 2. Climate change ‘governance triangle’ model.

According to Keohane and David Wicker, a mechanism complex is a specific set of loosely linked mechanisms that establishes links between specialized and relatively narrow mechanisms but without a structure to support the whole. Keohane organized the existing climate change mechanisms into a diagram. The diagram summarises the complex governance models, issues, and associated governance functions that are currently in place to address climate change [26]. Albert argued that Keohane’s concept and diagram of mechanism complexes only reflect the composition of the complex mechanisms for addressing climate change at the national level (see Figure 3) [19]. The vast majority of the mechanisms in these complexes are for rule-making and adaptation, and almost all of them can be applied to the state. This perspective of Keohane is only the tip of the iceberg of global governance of climate change. Based on this, Abbott proposed the concept of a ‘governance triangle’ in the climate field. The triangle of governance is the state, corporations, and civil society organization. By looking at the concept and content of the governance triangle, it could be seen that the “governance triangle” and the “institutional complex” are in an inclusive relationship. Thus, in Albert’s view, it is the ‘governance triangle’ that presents the true model of global climate governance. Albert then elaborated on the concept of

the governance triangle defining four competencies (independence, representativeness, expertise, and implementation) and four competencies for judging the effectiveness of the mechanism. The four competencies for judging the effectiveness of mechanisms (independence, representativeness, professionalism, and enforcement) and the five functions of control as a process (agenda setting, negotiation of standards, implementation, monitoring, and enforcement) are defined. Oran-Young presented a synthesis of institutional models concerning international environmental cooperation, based on which he analyzed and compared the advantages and disadvantages of various mechanisms. When talking about institutional interactions in the international community, he classifies interlinked regimes as embedded, nested, cluster, and overlapping regimes, thus providing different theoretical perspectives for analyzing international environmental cooperation: explanation and practical analysis of the theory of the climate change regime complex [27].

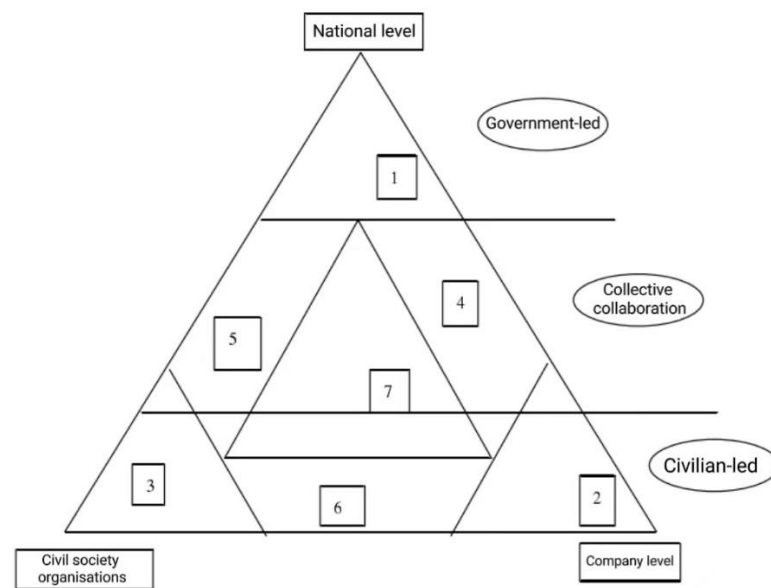


Figure 3. Climate change mechanism complex map.

Orsini et al. also saw ambiguity in the definition of the mechanism complex proposed by Rostand and Victor and proposed a related alternative definition of the mechanism complex, which they saw as “three or more international regimes that jointly manage the same issue; have overlapping memberships; and have substantive, normative or operational interactions in the management of the common issue. interaction.” In addition, some scholars have also argued that this concept of a regime complex is only agreed upon in terms of the factors that led to overlapping regimes, i.e., the overlapping mandates or functions of two or more international regimes or organizations, and shared membership, but other conceptual categories of the regime complex are fraught with controversy, such as the nature of the regimes and actors in the regime complex, the structure of the relationships between the elemental mechanisms, and the interaction of the types of relationships between mechanisms, etc. [28]. Based on such differences, some scholars have proposed the concept of a GGC, which is broadly defined as a system of overlapping institutions and actors that govern a particular global policy issue, consisting of a governance system of at least three international or transnational mechanisms or actors that have overlapping mandates, functions, and memberships and work together to solve a particular policy problem. They argued that the global governance mechanism complex emphasizes how the informal hierarchy that existed within the complex affects governance outcome; that the relationships between overlapping mechanisms within the complex are dynamic and changing; that the interaction of mechanisms within the complex was diverse, involving state and non-state interactions, cross-governmental and intergovernmental interactions, and formal and informal collaboration [29]. By combining the above definitions of mechanism

complexes, it can be appreciated that the elements essential to the analysis of mechanism complexes are sustained governance of the same problem, overlapping membership, and interaction between three or more mechanisms. Dissatisfaction with existing mechanisms may also motivate actors to create overlapping mechanisms and increase their complexity and fragmentation. Rostira and Victor suggested that states can resort to 'strategic incoherence' by creating rules in one basic regime that contradict another [30].

2.2. Research on the Interaction and Impact of Mechanism Fragmentation

Frank Biermann and others argue that the fragmentation of mechanisms is reflected in many ways. The main ones include institutional features, spatial scope, and dominant issues. In terms of institutional characteristics, there are a wide range of international organizations, international mechanisms, and other potential norms that are not explicitly defined in the international community; in terms of spatial scope, mechanisms are complex, both bilateral and multilateral; in terms of dominant topics, there are large differences between actors. Frank Biermann also classified the structural fragmentation of the governance system that occurs in a particular issue area as synergistic fragmentation, cooperative fragmentation, and conflictual fragmentation based on the differences in institutional integration, normative conflict, and actor structure [31].

Robert Keohane argued that the proliferation of mechanisms was motivated by rational choice and the game of power politics, that today's climate governance mechanisms under the UN framework have become difficult to govern in the international community due to their large shortcomings in terms of feasibility, arguing that policymakers should not be distracted by the pursuit of an elusive goal and that the holistic nature of multiple climate governance mechanisms is more important than one holistic climate governance mechanism is more flexible and better adapted to the current international community's climate governance. In the complexity of climate governance mechanisms, the UNFCCC play a more overarching role, providing the basic framework for climate governance and an effective platform for climate negotiations. He, therefore, argued that the need for flexibility and diversity in climate governance was best served by a loosely linked but effective complex climate governance regime.

In terms of the positive impacts of a complex mechanism, Amandine Orsin analyzed that a complex mechanism can provide a wider range of participation channels for participating actors, provide more platforms for dialogue and communication, and enhance the exchange of information between them. However, at the same time, while fragmentation provides a platform for other countries to participate, it also weakens the coercive power to force actors to comply with norms and agreements [32].

3. The Causes of the Institutional Complex of Global Climate Change

The climate change mechanism complex is a dynamic mechanism that is constantly changing. As Keohan et al. argued, the climate change mechanism complex operates on a lineage, with a fully integrated system that implements regulations through comprehensive and bureaucratic rules at one end. At the other end of the spectrum is a highly decentralized collection of institutions, with no discernible core and only weak or no connection between the different institutional elements. The reasons driving the operation of the complex are diverse. These reasons include not only internal reasons, such as the unique nature of climate change itself and the interweaving of power and interests, but also external reasons, such as globalization, the anarchy of the international society, and the impact of major international social events [33]. Overall, the causes of the climate change regime complex have been shaped by both internal and external logical frameworks.

3.1. The Internal Causes of the Global Climate Change Regime Complex

Unlike other global governance issues, climate change issues are highly interconnected, and the benefits of climate change governance are relatively uncertain, two unique attributes that offer the potential for the formation of a climate change regime complex. On the

one hand, the strong issue linkage means that climate change issues are interconnected with other issues, and mechanisms established and operating based on climate change governance will be interconnected with mechanisms established for issues such as energy governance and migration [34].

Cross-cutting mechanisms interact with and influence climate change mechanisms on specific issues, and as a result, the density of climate governance mechanisms is gradually increasing. Climate change is relevant to a wide range of governance issues, but other issues have their specificities, their governance challenges are different and the political groups behind them are not homogeneous. This has led to fragmentation and bottlenecks in identifying areas for cooperation in the governance of global climate change. On the other hand, climate governance often involves carbon emission reductions, and carbon reduction options face political issues. It is clear that the impact of carbon emissions reductions varies across countries at different levels of development and is particularly pronounced in the case of national economies.

Given the high costs of carbon emissions reductions and the uncertainty of their future benefits, the obvious short-term costs and uncertain long-term benefits make it difficult for national actors to compromise on climate governance. In the context of climate change, cooperation in combating climate change faces four inevitable problems: firstly, the issue of coordination in defining carbon emissions. This is the most central issue and the most difficult to coordinate. Secondly, the issue of compensation. For example, the transfer of funds and compensatory issues for developing countries that are reluctant to accept the definition of carbon emissions. Thirdly, the coordination of all parties to address climate change. Fourthly, the coordination of scientific assessments related to consensus. This issue has a degree of influence on public awareness and perceptions of the causes and impacts of climate change. All of these issues have a stimulating effect on the 'free-rider' phenomenon in national government departments, and there is a correlation between them.

On this basis, the implications of these three factors for the mechanisms involved in global climate governance are further elaborated. First, the configuration of benefits. Initially, the interests are reflected in the differences between the US and the EU concerning the Kyoto system of international climate governance. Nowadays, some representative developing countries have their interests in the construction of the system, resulting in a fragmentation of the preferences of different actors for the system. Secondly, the uncertainty is highlighted. Because of the high costs involved in compliance, most countries are unable to predict future benefits, and it is difficult to determine whether other countries and regions will agree to and implement similar carbon reduction treaties. At the same time, when looking at the global climate governance process, it is easy to see that perceptions, power, interests, and information are all changing rapidly. The rapid rise of China, the prominence of India's carbon emissions, and the changing perceptions of academics and the general public about the dangers of climate change are all representative of this [35]. To some extent, these changes have also shifted the paradigm of climate governance that was previously strongly endorsed by climate governance countries.

The existence of uncertainty has led to a lack of expectation of acceptance of climate governance agreements that must be supported by practical behavioral approaches. Thirdly, there are linkages between regimes. Some issue areas see linkages as a way to broaden the field of trade. It is also used in the design of partly diverse regimes to reinforce linkages within different issues, thereby reinforcing the potential benefits of cooperation and, at the same time, the willingness of countries to consciously comply with the regime. In the case of linkages, they are themselves capable of distinguishing the scope of different issues. Policy decisions that take into account the interconnectedness of systems can also have the effect of fragmenting them, but the links between them can also be relatively loose. Then, the climate issue, as an object of governance for the international community, remains shrouded in the shadow of divergent interests and power politics among the actors in governance, which can both expand the overlap of climate governance mechanisms and influence the direction of a particular regime complex [36,37].

Most scholars do not believe that regime complexes evolve naturally. Rather, the evolution of regime complexes is shaped by the interests and power of the actors that create and operate them. On the one hand, the issue of climate change has long transcended the scope of sovereign state management and covers a large number of actors, including states, sub-states, international organizations, multinational corporations, and even individuals. The diversity of actors means that climate governance mechanisms constructed by different actors have different interests bound up in the same issue. Interests can be both a bonding and a separating agent, with shared interests driving compatible goals and conflicting expectations accelerating the breakdown of relationships. Divergent interests may induce actors to use ‘forum shopping’ and mechanism shifting strategies, leading to an increasing density of climate mechanisms to address a particular issue, while whether or not divergent interests can be compromised and negotiated to achieve the greatest possible agreement directly affects the direction of the complex [38]. On the other hand, power politics directly influence the trend of the climate governance regime complex on the spectrum. In particular, those countries that are leaders in climate governance are likely to directly determine the direction of the spectrum and the effectiveness of a particular regime. In other words, the fragmentation of interests will reinforce the tendency for the system to become fragmented; on the other hand, if the system is built in a fragmented state, it will be difficult to align it with the overall interests of the dominant country. Therefore, the dominant countries will consciously invest a great deal of financial, material, and human resources in the development of institutions and will have the advantage of being the starting point of the “system builders”. In addition, they will explore the hierarchy and interconnectedness of different issues to build systems that match their interests and have continuity in the political sphere.

3.2. External Causes of the Global Climate Change Regime Complex

The rapid development of globalization and the anarchy of the international community are the external environmental factors for the formation of the climate governance mechanism complex and the prerequisites for the dynamic operation of the climate governance mechanism complex at both the loose and fully integrated, comprehensive ends of the spectrum.

The rapid development of globalization has not only brought about the cross-border movement of people, money, and other tangible materials but also led to increasing concern in the international community about climate change issues. The cross-sectoral inclusion of climate change issues has become an important choice for various governance mechanisms to meet the concerns of the international community, which in turn has led to an increase in the density of climate governance mechanisms and the overlapping of their members. The direction in which climate governance mechanisms operate depends on the degree of compatibility between the interacting mechanisms within the mechanism complex, and when the core norms and rules of the interacting mechanisms can be harmonized, then the mechanism complex is likely to operate in a more integrated direction. When the core norms and rules of the interacting mechanisms conflict with each other and are difficult to reconcile, the complex will move in the opposite direction. Moreover, in other spheres of global relations, the diversity of cooperation issues does not necessarily lead to institutional fragmentation or the emergence of institutional complexes. This is the case, for example, in the area of trade. However, the diversity of issues in the context of climate change highlights several reasons for the institutional fragmentation mentioned above.

The complexity of the configuration of interests and the rapidity of transformation due to the plurality of issues reinforces uncertainties and thus makes it difficult to effectively establish intrinsically trustworthy linkages. The anarchy of the international community has created external conditions for the formation of a complex of climate governance mechanisms in terms of their formation, linkages, and operation. Firstly, anarchy means that climate governance mechanisms cannot be established in a purely issue-oriented manner, that multiple governance mechanisms with overlapping functions can exist simultaneously

in the same issue area, and that they can complement or conflict with each other in the process of interaction. Secondly, anarchy suggests that there is no central mechanism that overrides the various climate governance mechanisms in the field of climate governance and that there is no formal hierarchy between climate governance mechanisms. Although informal hierarchical relationships exist within particular mechanism complexes or between interacting mechanisms, individual mechanisms may still be ‘abducted’ by the powerful subjects of which they are composed, or the mechanisms themselves may have an incentive to expand into neighboring issues, thereby contributing to the increasing density of climate governance mechanisms and the resulting overlap of their functions and membership. Finally, at the operational level, anarchy means that there is no central mechanism that can continuously coordinate the various climate governance mechanisms, and as a result, a complex of mechanisms for climate governance will move towards both ends of the spectrum as time changes and the dynamics of power relations between interests change. The relationship between the interacting mechanisms within the complex remains dependent on the ability of the mechanisms to use multiple strategies to reach ‘institutional reconciliation’ [39].

In summary, there are a variety of factors that influence the climate governance complex, and these factors will combine to drive the dynamics of the complex. While some of these factors are more powerful at a given time, the driving force of a combination of factors may change from time to time.

4. The Inherent Evolutionary Logic of the Global Climate Governance Regime Complex

4.1. The Involvement of Multiple Stakeholders in Governance Based on Institutional Fragmentation

In the context of the above-mentioned pattern of fragmented and evolving governance, Kenneth and Joseph suggested that the entire process of sustained multi-stakeholder participation in global climate governance can be distinguished into four stages: atomized, informally coordinated, networked, and resilient assemblage (see Figure 4) [40].

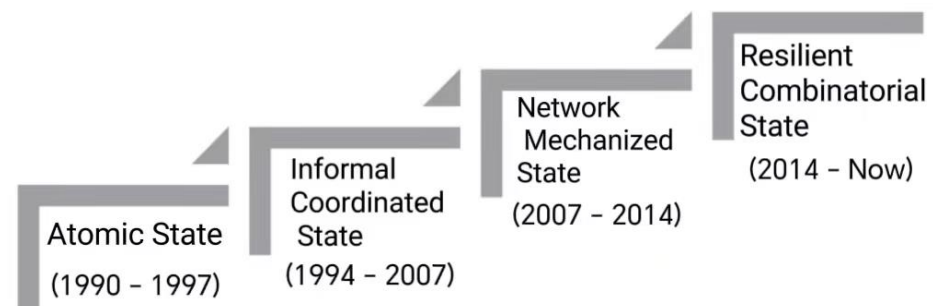


Figure 4. Four evolving levels of multi-stakeholder engagement in climate governance.

The core of this distinction is based on the level of institutionalization of the complex of non-state multi-stakeholder engagement mechanisms that were previously at the margins of governance, with each stage characterized by a plurality of interactions within non-state actors and with state actors.

(1) Stage 1. From the early 1990s until now, multilateral, country-led intra-government negotiations based on the framework of the Convention have defined the core mechanisms of global climate governance. Indeed, non-state actors and subnational regions are increasingly paying attention to this transnational issue and realize that they can improve their position in global climate governance through this global issue. However, various non-national and regional stakeholders have largely failed to exchange views and share information on the typical issues exposed in the process of global climate governance, resulting in an extremely decentralized system of non-governmental sector organizations, local government departments, corporate groups, social institutions, and other actors.

(2) Stage 2. From the signing of the Kyoto Protocol in 1997 until its entry into force in 2005, the number of international and even regional climate governance bodies based on the Convention has continued to grow. At the same time, climate change issues continued to spill over into other global institutions (e.g., the G7, the World Trade Organisation, and the World Bank), but non-state actors remained excluded from the main mechanisms, and their access to the key mechanisms of the Convention was limited.

(3) Stage 3. From 2007 onwards, through the Bali Roadmap to date, a growing number of non-state stakeholders have gradually reached an agreement on ways to promote their transnational action through cooperation. In particular, through the leading and coordinated communication and cooperation functions of some key actors, non-state stakeholders are gradually moving towards a transnational internet of cooperation in their involvement in global climate governance. For example, the Renewable Energy Policy Network for the 21st Century and the EU Covenant of Mayors Climate Action Platform.

(4) Stage 4. Based on Joseph Nye's theory, resilient assemblage refers to a mix of state and non-state actors within a defined range of issues, while in the lower political spheres, such as global climate, more and more resources, and most actions are controlled by non-state actors, while institutional pathways for interaction between the actors are continuously developed. In addition, the global climate governance regime is changing from a monocentric regime to a complex of multiple, weakly centered regimes, with various transnational collaborative advocacy networks, transnational low-carbon policy networks, and climate governance partnership linkages, based on the strengths of self-internet resilient governance, and the internal governance of government departments under a 'convention' framework. These strengths of self-internet resilient governance and enhanced cooperation within government departments also correspond to outreach units under the UNFCCC framework.

4.2. The Interactive Norms for Internal Actors of Climate Governance

Based on the above analysis, it is clear that in the context of global climate governance, the fragmentation of the mechanism has been accompanied by the strengthening of the capacity of non-state actors to participate and by the increasingly close and complex cooperation mechanisms within the different actors. Behind this situation, what is the logic behind the evolution of the complex global climate governance mechanisms? In the author's view, behind it lies a mechanism called "governance embeddedness", which highlights an internet-like embeddedness process in which various actors integrate and communicate with each other within the regime complex. This 'embeddedness' perspective focuses more on the roots of one type of variable within another or on the dependencies and symbiotic links within two types of things.

The rise of the new economic sociology in the 1980s was typified by Mark Granovetter's criticism of the shortcomings of mainstream economics in the socialization process and the over-socialization of sociology based on the embedding perspective, arguing that these two seemingly opposing views are a reflection of the corresponding actions of actors. The actor can neither develop a series of actions independently of the social context (a utilitarian behavior in pursuit of self-interest) nor can he or she simply start a mechanical action (a rigid socialization process) based on previous experiences and inferences, but rather he or she responds to a dynamic social system and a complex network of relations, seeking to achieve his or her multiple goals in this context.

Granovetter defined the concept of 'embeddedness' as a dynamic process of interaction between actors and social networks. Embedded governance is neither a 'top-down' governance path, with its emphasis on hierarchies of power, nor a 'bottom-up' governance path, with its normative governance based on civil society, but focuses more on the institutional complex of a pluralistic network-based order, through the public, private, and social sectors. The description of a multi-dimensional relationship of power between the public sector, the private sector, and social organizations, whose influence can be embedded at international, national, and sub-national levels, is presented below.

5. The Impact of Regime Complexes of Governance on Global Climate

Like the regime complex on other governing issues, the regime will have an impact on the effectiveness of climate governance, the operation of the climate institution, and international cooperation. The high density of mechanisms within the complex of climate governance, the interactive overlapping mechanism, and the unpredictable power behind the institution, combination, and disintegration of interests will affect the effectiveness and the operation of climate governance and the development of international cooperation. There is no conclusion regarding the impact of the regime complex on global governance, which has both positive and negative effects.

5.1. *The Positive Impact of the Regime Complexes of the Governance on Climate Change*

First, the complex mechanisms that have been formed around particular climate governance issues provide a diversity of governance options for multiple actors. The differences and divergent preferences of different actors can only be met within the regime complex, as the construction of a fully integrated and comprehensive regime is largely constrained by the political and practical national context in which climate change multi-stakeholder engagement is explored. As for the active participation of multilateral actors in the field of institution building, it results in a more diffuse collection of mechanisms, i.e., a complex of climate governance mechanisms. For policymakers, the mechanism complex itself has the advantage of being able to constrain the scale of global climate change. The advantages of this complex include, firstly, the flexibility of the issues and, secondly, the adaptability of time itself. The former refers to the fact that climate change provisions are not subsumed under the same mechanism, thus making the climate governance complex suitable not only for the active participation of multiple actors but also for a variety of contexts and issues.

As for the latter, it is mainly highlighted that the global climate governance complex can be more rationally adapted to the complex changes in regulations and behaviors and that decentralized linking mechanisms can encompass a diversity of institutional experiments. As policy optimality cannot be determined, it is feasible to provide an external environment that breeds optimal policies. The strength of the GCM complex itself stems from the policy-making structure itself, and such a policy-making paradigm can provide as much stakeholder interest demand as possible to stimulate different countries to join the global climate change governance team. Secondly, the multiple mechanisms within the regime complex compete on a specific climate governance issue, and to better ensure their survival and development, the mechanisms themselves have the incentive to change themselves or to cooperate with other mechanisms to govern in response to societal needs. Thus, it can be argued that a complex of climate governance mechanisms has the potential to enhance cooperation between mechanisms, thereby strengthening the links between them and facilitating the implementation of other climate governance mechanisms.

For example, in the context of global climate governance, a complex of mechanisms could contribute to the implementation of a global emissions trading strategy. Finally, the climate governance regime complex provides a liberal and diverse environment for international cooperation. Theoretically, a polycentric rather than a monocentric system of governance also provides more opportunities for experimentation with policies that can be improved over time. At the same time, the absence of formal hierarchical relationships within the complex climate governance mechanisms means that there is no monopoly on climate governance by a single mechanism in the field of climate governance, and the overlapping of functions between different mechanisms reduces the likelihood of overlooking problems caused by avoidance of responsibility [41]. Furthermore, even if a mechanism presents a loosely connected state, it can provide the needed development opportunities in place of innovative compensatory mechanisms for land use and forest energy depletion [42]. At the same time, a complex of mechanisms can be more useful in managing and controlling global climate change than a single, integrated global climate governance mechanism and can be more rational in resolving contradictions with other

global cooperation frameworks, as well as strengthening the coordination mechanisms within them, thus allowing for a deeper and more coherent system of rules and regulations.

In addition, the flexibility of the regime complex itself can offer the possibility of cooperation with other actors that can contribute to the achievement of carbon reduction targets, as exemplified by increased investment in the areas of research and development. The polycentric governance system created by the CGM complex also offers the potential for ‘inter-regime learning’ and helps to strengthen communication and interaction between the parties to the international regime, thereby helping to foster the mutual trust required for international cooperation [43,44]. Finally, several features of the complexity of mechanisms—competition between mechanisms, fragmentation of authority, and the opportunity to select courts—can provide the conditions for the development of global democratization [45].

5.2. The Negative Impact of the Regime Complexes of the Governance on Climate Change

In addition to the positive impacts of the climate governance regime complex described above, there are possible negative impacts that require careful consideration by scholars and policymakers. First, in terms of the effectiveness of climate governance, not all scholars agree with the view that a complex of mechanisms can help reduce the evasion of responsibility by actors. For example, some scholars argue that overlapping mechanisms may have negative impacts, such as leading to confusion over authority, unclear organizational boundaries, and uncertainty over rules. This, in turn, may lead to weaker accountability and lower levels of compliance with international commitments. Secondly, the existence of a complex of climate governance mechanisms can weaken the effectiveness of the operational climate regime in solving problems and can lead to duplication of governance efforts, resulting in a waste of governance resources [46]. For example, Orsini notes that a complex of mechanisms may lead to duplication of effort. At the same time, international mechanisms are also relatively autonomous, and in the context of a complex of mechanisms spread across the climate governance landscape, competition between mechanisms can lead to turf battles between their bureaucracies, which in turn can reduce the efficiency of the mechanisms in performing their functions [47].

The high density of climate regimes is one of the characteristics of the climate regime complex, but while this high density indicates a proliferation of climate governance regimes, it can also lead to what international legal scholars call ‘treaty congestion’, a term that implies a conflict in the objectives, obligations or procedures of the regimes [48]. Therefore, although the UNFCCC is the core mechanism in the field of climate governance, the increasing competition, conflicts, and frictions between the mechanisms will make it more difficult to integrate the UNFCCC with other mechanisms, making it difficult to achieve effective synergies between the mechanisms in the short term. In addition, while the existence of a complex of climate governance mechanisms may help small and weak countries to implement climate governance policies, it will amplify and strengthen the power of powerful actors who can manage complex contexts but will place a heavy burden on weak actors, thus exacerbating the power imbalance. Finally, complex climate governance mechanisms have the potential to weaken the propensity for international cooperation [49].

While a variety of governance mechanisms have been agreed upon by various actors, the powerful main actors are increasingly engaged in negotiations over the financing, technology, and emissions reductions of climate governance, and, as analyzed above, the high and certain short-term costs of climate governance and the uncertainty of its long-term benefits have led even the powerful actors to be reluctant to take on too much responsibility. At the same time, there is a growing tendency to divide the interests of countries based on their climate governance interests, with a mismatch between responsibility and capacity and a fragmentation of national interests emerging in the international community. For example, the North and South camps within the Convention have almost disappeared, the negotiating coalition has been divided and combined, the EU and AOSIS are nearby, China

is increasingly taking on the obligations of developed countries, and interests are becoming more fragmented and more difficult to integrate [50].

Given the mixed impacts of the climate governance complex, it is difficult to generalize whether positive or negative impacts will dominate climate governance issues, depending on how the elements of the complex evolve in the climate governance process. Taken together, the formation of the global climate governance regime complex has its theoretical underpinnings as well as its causes. Therefore, it is necessary to explore the internal logic of the GCM complex and focus on the policy implications of the GCM complex. In the current landscape, both the political reality and the need for flexibility and diversity suggest that the best option is to try to build a complex of mechanisms for climate change that are fragmented but effective.

This complex of mechanisms exists across the spectrum of global governance issues and is shaped both internally by the unique nature of the climate change issue and the interplay of power and interests and externally by the rapid growth of globalization and the anarchy of the international community. The dual internal and external logical frameworks together shape the dynamics of the climate regime complex. The climate regime complex has a dual impact on the effectiveness of climate governance, the functioning of the interaction mechanisms, and international cooperation on climate governance. At the same time, the climate regime complex also exhibits different evolutionary patterns and logic at different stages. Against the background of General Secretary Xi Jinping's clear proposal that China will achieve carbon peaking by 2030 and carbon neutrality by 2060, how can China, in the context of the climate regime complex characterized by a pluralistic and weak center, unite multiple governance actors and use multiple diplomatic means to promote the climate regime complex. The key question we must consider in the future is how to balance our interests and the interests of multiple parties in the process of relatively integrated and comprehensive development of the climate regime complex, thereby promoting our low-carbon green transition and strengthening the positive effects of global climate governance.

6. Conclusions

The complex mechanism studied in this paper is a hot topic of research at the intersection of the fields of institutional studies and global governance studies. The mechanism complex at different levels operating in the complex world economic and political environment is a bridge and link between the two. In the management process of mechanisms, identifying and making full use of dominant functional mechanisms will be an important grip in the struggle for climate governance today. It is important to note that the dominant functional mechanism does not necessarily come from under the sole domination of state actors; the future trend is for platforms such as multinational corporations and global civil society to play a greater role. Therefore, as the dominant governance actor of the moment, the state must not only play a strong role in international mechanisms within the UN framework but also have the foresight to guide the development and practice of NGOs. The process of establishing mechanisms requires gaming and reconfiguration. It is unrealistic to advocate a perfect climate governance mechanism, but it is important to make the best use of its superiority based on reality. Current climate governance should focus on the management process; future climate governance should focus on innovative mechanisms. Both the concept of mechanism complex proposed by Keohane and the theory of "governance triangle" proposed by Abbott provide directions for the international community to deal with climate change in practice. However, at a time when a complete international climate change mechanism complex is not yet mature, we need to call for greater innovation in international climate governance mechanisms in the future. These contributions are catalysts for social and historical development, and this is a good thing as long as the general trend is one of progress.

Global climate governance remains an effective form of addressing global climate change and solving the global climate crisis, but its paradigm may change accordingly. The

complexity of the mechanisms currently emerging in the field of global climate governance may be leading the current governance model into the future: the inter-nested system of regimes allows for a greater variety of participation options for participating subjects, further promoting equality among members, and more and more subdivisional regimes also highlight greater expertise. The competitive nature of the systems will also eliminate inefficient and functionally overlapping parts of the system in the competition, and more participation platforms will also enable more non-governmental subjects to play a greater role to make up for the shortcomings of the state.

Author Contributions: Conceptualization, E.B. and L.Z.; methodology, E.B. and L.Z.; software, E.B.; validation, E.B. and L.Z.; formal analysis, E.B.; investigation, E.B.; resources, E.B.; data curation, E.B.; writing—original draft preparation, E.B.; writing—review and editing, L.Z.; visualization, L.Z.; supervision, L.Z.; project administration, L.Z. All authors have read and agreed to the published version of the manuscript.

Funding: The National Social Science Fund of China (General Program: “Study on The Regime Complexes for Climate Governance and Countermeasures”; Grant No. 20BGJ018).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Abbreviations

UNFCCC	United Nations Framework Convention on Climate Change
NGO	Non-Governmental Organization
GGC	Global Governance Complex
GCM	Global Climate Model
AOSIS	Alliance of Small Island States

References

1. Tian, G.; Lu, W.; Zhang, X.; Zhan, M.; Dulebenets, M.A.; Aleksandrov, A.; Fathollahi-Fard, A.M.; Ivanov, M. A survey of multi-criteria decision-making techniques for green logistics and low-carbon transportation systems. *Environ. Sci. Pollut. Res.* **2023**, *30*, 57279–57301. [[CrossRef](#)] [[PubMed](#)]
2. Tian, G.; Zhang, C.; Fathollahi-Fard, A.M.; Li, Z.; Zhang, C.; Jiang, Z. An Enhanced Social Engineering Optimizer for Solving an Energy-Efficient Disassembly Line Balancing Problem Based on Bucket Brigades and Cloud Theory. *IEEE Trans. Ind. Inform.* **2022**, *19*, 7148–7159. [[CrossRef](#)]
3. Rummukainen, M. Climate change: Changing means and changing extremes. *Clim. Chang.* **2013**, *121*, 3–13. [[CrossRef](#)]
4. Hulme, M.; Barrow, E.M.; Arnell, N.W.; Harrison, P.A.; Johns, T.C.; Downing, T.E. Relative impacts of human-induced climate change and natural climate variability. *Nature* **1999**, *397*, 688–691. [[CrossRef](#)]
5. Gosling, S.N.; McGregor, G.R.; Lowe, J.A. The benefits of quantifying climate model uncertainty in climate change impacts assessment: An example with heat-related mortality change estimates. *Clim. Chang.* **2012**, *11*, 217–231. [[CrossRef](#)]
6. Dannenberg, A.L.; Rogerson, B.; Rudolph, L. Optimizing the health benefits of climate change policies using health impact assessment. *J. Public Health Policy* **2020**, *41*, 139–154. [[CrossRef](#)]
7. McMichael, A.J. Health consequences of global climate change. *J. R. Soc. Med.* **2001**, *94*, 111–114. [[CrossRef](#)]
8. Qian, X.M.; Li, J.X. The process and impact of global climate governance: A case study of the Paris Climate Agreement. In Proceedings of the 6th International Conference on Advances in Energy, Environment and Chemical Engineering (AEECE), Electr Network, Shanghai, China, 19–21 June 2020. [[CrossRef](#)]
9. Suseeya, K.R.M.; Elhard, D.K.; Paul, C.J. Toward a relational approach in global climate governance: Exploring the role of trust. *Wiley Interdiscip. Rev.-Clim. Chang.* **2021**, *12*, e712. [[CrossRef](#)]
10. Janicke, M. The Multi-level system of global climate governance—the model and its current state. *Environ. Policy Gov.* **2017**, *21*, 108–121. [[CrossRef](#)]
11. Qi, J.J.; Dauvergne, P. China’s rising influence on climate governance: Forging a path for the global South. *Glob. Environ. Chang.-Hum. Policy Dimens.* **2022**, *73*, 102484. [[CrossRef](#)]
12. Pattberg, P.; Kaiser, C.; Widerberg, O.; Stripple, J. 20 Years of global climate change governance research: Taking stock and moving forward. *Int. Environ. Agreem.-Politics Law Econ.* **2022**, *22*, 295–315. [[CrossRef](#)]

13. Verkerk, J.; Teisman, G.; Van Buuren, A. Synchronising climate adaptation processes in a multilevel governance setting: Exploring synchronisation of governance levels in the Dutch Delta. *Policy Politics* **2015**, *43*, 579–596. [[CrossRef](#)]
14. Liu, M.S.; Lo, K. Governing eco-cities in China: Urban climate experimentation, international cooperation, and multilevel governance. *Geoforum* **2021**, *121*, 12–22. [[CrossRef](#)]
15. Lawhon, M.; Murphy, J.T. Socio-technical regimes and sustainability transitions: Insights from political ecology. *Prog. Inhuman Geogr.* **2012**, *36*, 354–378. [[CrossRef](#)]
16. Smith, A.; Stirling, A. The Politics of social-ecological resilience and sustainable socio-technical transitions. *Ecol. Soc.* **2010**, *15*. [[CrossRef](#)]
17. Haupt, W. How do local policy makers learn about climate change adaptation policies? Examining study visits as an instrument of policy learning in the European Union. *Urban Aff. Rev.* **2021**, *57*, 1697–1729. [[CrossRef](#)]
18. Neij, L.; Heiskanen, E. Municipal climate mitigation policy and policy learning—A review. *J. Clean. Prod.* **2021**, *317*, 128348. [[CrossRef](#)]
19. Abbott, K.W. The transnational regime complex for climate change. *Environ. Plan. C-Gov. Policy* **2012**, *30*, 571–590. [[CrossRef](#)]
20. Yu, H.Y. Rebalancing global climate governance and China's endeavor. *China Q. Int. Strateg. Stud.* **2019**, *5*, 417–435. [[CrossRef](#)]
21. Mauad, A.; Betsill, M. A changing role in global climate governance: São Paulo mixing its climate and international policies. *Rev. Bras. Política Int.* **2019**, *62*, e009. [[CrossRef](#)]
22. Hough, P. International Institutions: An international organization reader. *Political Stud.* **2002**, *50*, 1042–1043.
23. Krasner, S.D. Structural causes and regime consequences: Regimes as intervening variables. *Int. Organ.* **1982**, *36*, 185–205. [[CrossRef](#)]
24. Hof, A.F.; den Elzen, M.G.J.; van Vuuren, D.P. Environmental effectiveness and economic consequences of fragmented versus universal regimes: What can we learn from model studies? *Int. Environ. Agreem.* **2009**, *9*, 39–62. [[CrossRef](#)]
25. Keohane, R.O.; Victor, D.G. The regime complex for climate change. *Perspect. Politics* **2011**, *9*, 7–23. [[CrossRef](#)]
26. Abbott, K.; Snidal, D. The governance triangle: Regulatory standards institutions and the shadow of the state. In *The Politics of Global Regulation*; Princeton University Press: Princeton, NJ, USA, 2009; pp. 44–88.
27. Young, O.R. Institutional linkages in international society: Polar perspectives. *Glob. Gov.* **1996**, *2*, 1–24. [[CrossRef](#)]
28. Orsini, A.; Morin, J.F.; Young, O. Regime complexes: A buzz, a boom or a boost for global governance. *Glob. Gov.* **2013**, *19*, 29. [[CrossRef](#)]
29. Eilstrup-Sangiovanni, M.; Westerwinter, O. The global governance complexity cube: Varieties of institutional complexity in global governance. *Rev. Int. Organ.* **2022**, *17*, 233–262. [[CrossRef](#)]
30. Raustiala, K.; Victor, D.G. The regime complex for plant genetic resources. *Int. Organ.* **2004**, *58*, 302. [[CrossRef](#)]
31. Biermann, F.; Pattberg, P.; Asselt, H.V.; Zell, F. The fragmentation of global governance architectures: A framework for analysis. *Glob. Environ. Politics* **2009**, *9*, 16. [[CrossRef](#)]
32. Benvenisti, E.; Downs, G.W. The empire's new clothes: Political economy and the fragmentation of international law. *Stanf. Law Rev.* **2007**, *60*, 595–631.
33. Daniel, W. The power and peril of international regime complexity. *Perspect. Politics* **2009**, *7*, 65–70. [[CrossRef](#)]
34. Aggarwal, V. Reconciling multiple institutions: Bargaining, linkages, and nesting. In *Institutional Designs for a Complex World: Bargaining, Linkages, and Nesting*; Cornell University Press: Ithaca, NY, USA, 1998; pp. 1–31. [[CrossRef](#)]
35. Erdogan, S.; Pata, U.K.; Solarin, S.A.; Okumus, I. On the persistence of shocks to global CO₂ emissions: A historical data perspective (0 to 2014). *Environ. Sci. Pollut. Res.* **2022**, *29*, 77311–77320. [[CrossRef](#)] [[PubMed](#)]
36. Akalin, G.; Erdogan, S. Does democracy help reduce environmental degradation? *Environ. Sci. Pollut. Res.* **2021**, *28*, 7226–7235. [[CrossRef](#)]
37. Ullah, S.; Luo, R.D.; Adebayo, T.S.; Kartal, M.T. Paving the ways toward sustainable development: The asymmetric effect of economic complexity, renewable electricity, and foreign direct investment on the environmental sustainability in BRICS-T. *Environ. Dev. Sustain.* **2023**. [[CrossRef](#)]
38. Alter, K.J.; Meunier, S. The politics of international regime complexity. *Perspect. Politics* **2009**, *7*, 13–24. [[CrossRef](#)]
39. Kellow, A. Multi-level and multi-arena governance: The limits of integration and the possibilities of forum shopping. *Int. Environ. Agreem. Politics Law Econ.* **2012**, *12*, 327–342. [[CrossRef](#)]
40. Li, X.L. Governance nesting: The evolutionary logic of the global climate governance regime complex. *Eur. Stud.* **2018**, *36*, 91–116.
41. Oberthur, S. Interplay management: Enhancing environmental policy integration among international institutions. *Int. Environ. Agreem. Politics Law Econ.* **2009**, *9*, 371–391. [[CrossRef](#)]
42. Young, O.R. Institutional dynamics: Resilience, vulnerability and adaptation in environmental and resource regimes. *Glob. Environ. Chang.* **2010**, *20*, 378–385. [[CrossRef](#)]
43. Ostrom, E. Polycentric systems for coping with collective action and global environmental change. *Glob. Environ. Chang. Part A Hum. Policy Dimens.* **2010**, *20*, 550–557. [[CrossRef](#)]
44. Lofthouse, J.K.; Herzberg, R.Q. The continuing case for a polycentric approach for coping with climate change. *Sustainability* **2015**, *15*, 3770. [[CrossRef](#)]
45. Kuyper, J.W. Global democratization and international regime complexity. *Eur. J. Int. Relat.* **2014**, *20*, 620–646. [[CrossRef](#)]
46. Kuyper, J. Deliberative capacity in the intellectual property rights regime complex. *Crit. Policy Stud.* **2015**, *9*, 317–338. [[CrossRef](#)]

47. Raustiala, K. Institutional proliferation and the international legal order. In *Interdisciplinary Perspectives on International Law and International Relations: The State of the Art*; Cambridge University Press: Cambridge, UK, 2012; pp. 293–320. [[CrossRef](#)]
48. Orsini, A. The negotiation burden of institutional interactions: Non-state organizations and the international negotiations on forests. *Camb. Rev. Int. Aff.* **2016**, *29*, 1421–1440. [[CrossRef](#)]
49. Weiss, E.B. International environmental law: Contemporary issues and the emergence of a new world order. *Georget. Law J.* **1993**, *81*, 675–710.
50. Zelli, F.; Asselt, H.V. Introduction: The institutional fragmentation of global environmental governance: Causes, consequences, and responses. *Glob. Environ. Politics* **2013**, *13*, 1–13. [[CrossRef](#)]

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.