• Article •

China's Role in the Global Governance of Synthetic Biology: Between Revisionism and the Status Quo

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Abstract: As a rapidly evolving frontier technology, synthetic biology poses significant global governance challenges that remain underexplored in international relations. This study combines the institutional design framework of global governance with the status quo–revisionist lens from international political economy to assess China's role in the global governance of synthetic biology. It finds that China introduced the Tianjin Biosecurity Guidelines as a soft-law instrument that complements the hard-law Biological Weapons Convention, enhancing scientific community engagement and fostering consensus in research and regulation. The study concludes that China adopts a bounded revisionist approach, advancing normative innovation within the framework of existing institutions rather than in opposition to them. More broadly, the Tianjin Biosecurity Guidelines demonstrate how states can employ soft law to supplement established yet incomplete global governance frameworks, strategically position themselves, and secure international support. This study thus offers new insights into the dynamic alignment of state strategies and institutional design in the global governance of emerging technologies.

Keywords: Global Governance; China; Bounded Revisionism; Synthetic Biology; Emerging Technologies

1. Introduction

In the context of globalization, the transnational allocation and mobility of scientific and technological resources have emerged as defining characteristics of modern research and innovation. Biotechnology as a key driver of the Fourth Industrial Revolution has become increasingly relevant to practical applications. Among its subfields, synthetic biology stands out as a foundational pillar of modern bio-innovation, embodying this broader technological shift. Synthetic biology merges biology with engineering, marking a shift in the life sciences paradigm—from 'understanding before creating' to 'creating before understanding' (Peng, 2020). Today, it is applied across diverse sectors such as agriculture, energy, manufacturing, and medicine.

As an emerging and transformative technology, synthetic biology holds vast potential for application. However, at the same time, research that breaks through the laws of natural evolution entails numerous unpredictable and latent risks, particularly in terms of biosafety and biosecurity. Biosafety primarily refers to biological risks caused by unintentional or accidental incidents, while biosecurity risks encompass threats such as the misuse of synthetic biology for bioweapons, bioterrorism, and cyber-biosecurity issues (Wang & Zhang, 2019). A defining characteristic of synthetic biology lies in the decoupling of design and manufacturing processes—a feature that, when coupled with the global reach of the internet and increasing accessibility to biotechnological knowledge, facilitates the formation of transnational interactive networks. Given these interconnected dynamics, any effort to manage or mitigate the risks associated with synthetic biology must ultimately take shape at the international level (Peng, 2020, p.56). Currently, the governance of synthetic biology across countries is marked by high uncertainty and limited decision-making guidance (Trump, 2017). There is a global need for effective regulation and governance to ensure the safety and sustainability of synthetic biology.

The World Economic Forum's 2021 report Global Technology Governance pointed out that there are significant governance gaps in emerging technology fields, ranging from regulatory vacuums and misuse risks to privacy concerns, enforcement difficulties, and cross-border inconsistencies. In contrast to traditional models of global technology governance—where international science and technology organizations typically function at a higher level to coordinate scientific resources, advance research agendas, and promote progress within specialized disciplines (Luo & Cheng, 2013)—the governance of emerging technologies places greater emphasis on normative guidance. Its core objective is to ensure that the development and deployment of new technologies align with broader societal goals and ethical standards. In this sense, it carries greater responsibility in guiding the trajectory of global scientific and technological development.

Innovative governance models have already been introduced across various emerging technology sectors. For example, in financial technology, the UK’s Financial Conduct Authority (FCA), together with other international regulators, established the Global Financial Innovation Network (GFIN)—a collaborative platform that functions as a global sandbox for piloting regulatory strategies. In the domain of autonomous driving, the United Nations Economic Commission for Europe (UNECE) convened a regulatory forum that successfully brought together over 50 countries across Europe, Asia, and Africa, resulting in a consensus to implement rules governing Automated Lane Keeping Systems (ALKS) beginning in January 2021.

Despite China's growing participation in global governance, its engagement in the governance of science and technology remains relatively underexplored in academic scholarship. Existing studies have predominantly focused on China’s involvement in areas such as development finance, global health, and climate change—fields that tend to have more immediate and tangible global consequences, and thus attract greater scholarly attention. In contrast, the governance of science and technology is often regarded as a more technical and specialized domain, resulting in limited academic engagement. This

study seeks to address this gap by integrating the institutional design framework of global governance with the 'status quo vs. revisionist' framework from international political economy to examine China's role in the global governance of synthetic biology. By doing so, this study not only enhances understanding of China's engagement in the governance of emerging technologies, but also offers new theoretical insights into the evolving relationship between state strategies and institutional design in the global governance of emerging technologies.

This paper is structured as follows. Section 2 reviews the existing literature on global governance of emerging technologies, with particular emphasis on its defining characteristics and China's evolving role. Section 3 focuses on the global governance of synthetic biology, addressing key issues of biosafety, biosecurity, and associated governance challenges. Section 4 analyzes China's participation in synthetic biology governance through the Tianjin Biosecurity Guidelines case study. Finally, Section 5 concludes by summarizing the main findings and discussing their broader implications.

2. Literature Review: China and Global Emerging Technology Governance

2.1 Global Emerging Technology Governance

To analyze the governance of emerging technologies, the institutional design framework developed by Koremenos, Lipson, and Snidal (2001) provides five key dimensions: membership, scope, centralization, control, and flexibility. Among these, scope and centralization are particularly relevant to the governance challenges posed by emerging technologies. The scope of governance frameworks—defined as the breadth of issues they encompass—is a particularly debated feature in the context of emerging technology regulation. While horizontal approaches integrate multiple policy sectors, vertical approaches are confined to a single policy domain or technological application (Tallberg, et.al, 2023). Centralization addresses whether governance tasks are coordinated through a central authority or distributed among multiple actors. Centralization can facilitate more efficient information sharing, lower bargaining and transaction costs, and improve the effectiveness of enforcement.

Recent scholarship on the global governance of artificial intelligence (AI) introduces an additional analytical dimension: the distinction between hard law and soft law (Tallberg et al., 2023). Hard law encompasses binding legal instruments such as domestic legislation and international treaties. Examples include ISO technical standards, ASEAN's Model Contractual Clauses (MCC) for cross-border data flows, and network-layer interface protocols. In the governance of technological innovation, hard law tends to fulfill regulatory functions, especially in phases where international trade requires consistency in goods and services. These instruments aim to establish technical standards, erect technical barriers, facilitate patent commercialization, secure industrial advantage, and consolidate market access (Xue, 2023).

By contrast, soft law refers to non-binding instruments such as guidelines of conduct, resolutions, declarations, and codes of conduct, etc (Abbott & Snidal, 2000). Examples of soft law include the OECD Guidelines on the Protection of Privacy and Transborder Flows of Personal Data, UNESCO's

Recommendation on the Ethics of Artificial Intelligence, etc. These soft rules generally serve the 'developmental' governance needs, applicable in areas with minimal international disputes and difficult negotiations. Their purpose is to build consensus, facilitate cooperation, and enable interest-based exchanges (Xue, 2023), which seems more in line with the needs of emerging technology governance.

In sum, existing research suggests that the governance of emerging technologies is best analyzed along three core dimensions: scope, centralization, and the degree to which instruments are based on hard or soft law. These dimensions serve as a foundation for evaluating how global governance systems respond to emerging technological challenges, including synthetic biology.

2.2 China's Role in the Global Emerging Technology Governance

The 'status-quo vs. revisionist' framework has become a widely used analytical lens in international relations to assess the behavior of rising powers. A status-quo power is generally understood as one that seeks to preserve the existing international order or incrementally reform global institutions without fundamentally altering the distribution of power (Johnston, 2003). In contrast, a revisionist power aims to challenge, undermine, or replace prevailing norms and institutions, often by bypassing traditional mechanisms, promoting alternative governance models, or establishing parallel institutions (Ikenberry, 2008). This binary framework, rooted primarily in realist power transition theory, has long shaped debates on China's rise in global governance. Within this evolving analytical landscape, three major strands of scholarly interpretation have emerged.

The first strand characterizes China as a status-quo power, particularly within the sphere of global economic governance. This literature emphasizes China's willingness to operate within established institutional arrangements to advance its long-term development objectives. For instance, its continued support for the multilateral trading system under the WTO reflects both a commitment to institutional participation and a strategic effort to safeguard national interests (Wang & Zhou, 2023). Nevertheless, some scholars contend that China's engagement is primarily instrumental rather than normative, arguing that its compliance with existing rules is driven by utilitarian calculations rather than an internalization of liberal international norms (Glaser, 2011; Breslin, 2013). From this perspective, China is better understood as a pragmatic actor seeking stability and access within the current order, rather than as a revisionist force. While not ideologically aligned with the liberal order, China's preference for incremental reform over systemic disruption reinforces its status-quo orientation in this domain.

The second strand depicts China as a revisionist force, especially in issue areas where it perceives Western-dominated institutions as unrepresentative or unresponsive to the interests of the emerging economies. In these areas, China has actively sought to reshape governance architectures by proposing alternative norms and creating parallel institutions. Examples include the establishment of the Asian Infrastructure Investment Bank (AIIB), which aim to provide development finance outside the traditional Bretton Woods system (Qian, Vreeland, & Zhao, 2023). Moreover, the Belt and Road Initiative (BRI) proposed by China is interpreted as efforts to promote a distinct model of globalization, one that prioritizes infrastructure, sovereignty, and non-interference (Paradise, 2019). In this view,

China's behavior signals dissatisfaction with the normative underpinnings of the liberal order and a desire to reshape it in line with its own preferences.

A third, more nuanced view characterizes China as a bounded revisionist or hybrid actor—a power that operates within the existing system while selectively seeking to reshape aspects of it. This literature contends that China's behavior in global governance reflects a pragmatic blend of adaptation, resistance, and innovation, shaped by sector-specific dynamics and institutional path dependencies. Scholars in this camp emphasize that global norms and institutions are not fixed but are subject to ongoing renegotiation and reinterpretation, allowing rising powers to exert influence without directly challenging the system (Johnston, 2003; Hopewell, 2025). For instance, in the domain of climate governance, China has actively participated in multilateral processes such as the UNFCCC, contributing to international consensus-building, while simultaneously advocating for principles like 'common but differentiated responsibilities' that align with its developmental priorities (Yang, 2022). This perspective suggests that China's behavior is best understood as strategically adaptive, with its stance shaped by the particular dynamics and normative expectations of a particular governance domain.

While China's involvement in areas such as development finance and climate governance has received considerable scholarly attention, its growing role in global technology governance remains relatively underexplored. In recent years, relatively speaking, China's engagement in international standard-setting has attracted increasing academic interest as China have devoted significant political and financial resources to securing leadership roles in major international bodies such as the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), and the International Telecommunication Union (ITU). For example, China currently occupies key positions in ISO/IEC SC 42 (focused on Artificial Intelligence), and Chinese delegates—primarily representing state-linked institutions—play leading roles in shaping AI-related standards at the ITU (Gamito, 2023).

This transformation—from a 'standards taker' to a 'standards maker'—demonstrates China's strategic ambition to influence global norms while navigating between domestic interests and international cooperation (Driessen & Zhu 2024). In addition, scholars are divided on China's actual influence: some argue that standard-setting bolsters China's rise as a cyber power (Russel & Berger 2021), while others contend that its proposals are less frequently adopted and its influence remains constrained (Fägersten & Rühlig 2019; Schott & Schaefer 2023).

Given the disputed views on the actual impact of China in international standardization, it can be concluded that China has increasingly adopted a bounded revisionist role, to selectively reshape current standards within the existing global governance system of Information and Communication Technology (ICT) standards—a domain generally associated with hard law, although the degree of legal bindingness varies across different standard-setting bodies.

This study aims to explore China's evolving role in the global governance of synthetic biology—a critical yet underexplored frontier in emerging technology governance.

3. Global Governance of Synthetic Biology

As the core concerns in synthetic biology governance center on biosafety and biosecurity, thus global governance in this domain is primarily structured along these two axes. In the area of biosafety, governance is dominated by the Convention on Biological Diversity (CBD) and its protocols, which originated within the broader context of biodiversity regulation. While the CBD itself is a legally binding treaty, its current governance of synthetic biology relies on non-binding 'recommendatory decisions' that exhibit soft-law characteristics. In the area of biosecurity, although the governance system is more fragmented than biosafety, it is equally reliant on soft-law mechanisms despite its higher-stakes nature. Taken together, these arrangements constitute a global governance system that is characterized by a horizontal scope and a certain degree of decentralization.

3.1 Biosafety Governance

In the area of biosafety, CBD mainly dominates the global governance of synthetic biology while soft laws play complementary roles. The Convention on Biological Diversity (CBD) serves as the main international forum for discussing regulatory issues concerning synthetic biology (Keiper & Atanassova, 2020), which outlines global principles for biodiversity protection and the regulation of genetic resources. Based on the CBD, the United Nations has successively adopted three supplementary protocols: the Cartagena Protocol (2003) extends these principles by regulating living modified organisms (LMOs), a category under which synthetic biology products may fall. Complementing this, the Nagoya Protocol (2014) and its Nagoya-Kuala Lumpur Supplementary Protocol (2018) address access and benefit-sharing (ABS) as well as liability issues arising from the release of modified organisms. While the CBD and its supplementary protocols provide the legal foundation for biosafety governance, the actual interpretation and advancement of synthetic biology regulation occur primarily through the decisions made at the COP (Conference of the Parties) meetings, the highest decision-making body of the Convention on Biological Diversity (CBD). Early COPs (COP10–COP12) focused on potential impacts without firm action. Later meetings (COP13–COP14) introduced an operational definition and emphasized risk assessment, particularly for gene drives. By COP15, debates intensified around gene drives and digital sequence information (DSI), but consensus was lacking. Although the CBD's approach to synthetic biology has evolved from cautious observation to increased engagement, progress remains slow due to regulatory fragmentation and political disagreement, especially between developed and developing countries (Keiper & Atanassova, 2020).

In addition to formal decisions under the CBD framework, biosafety governance is also supported by non-binding technical standards, most notably the WHO's Laboratory Biosafety Manual, which offers detailed protocols for safe handling of biological materials in clinical and research contexts. Additional WHO documents provide soft law guidance on risk management strategies related to genetically modified mosquitoes, a prominent application of synthetic biology for disease control. These soft law instruments, while lacking legal enforcement power, play a critical role in standardizing lab practices and risk assessments, especially in countries lacking strong domestic biosafety legislation.

3.2 Biosecurity Governance

Whereas biosafety focuses on unintentional risks, biosecurity governance addresses the potential malicious use of synthetic biology. The Biological Weapons Convention (BWC) complements the CBD's governance of synthetic biology by addressing biosecurity concerns, particularly regarding the use of synthetic components, organisms, and products for hostile purposes or armed conflict. However, the BWC has limitations in governing emerging biosecurity challenges in synthetic biology. For instance, it doesn't address research activities that could facilitate the development of biological weapons, and its scope remains narrow in anticipating and managing broader risks posed by synthetic biology applications (Gómez-Tatay & Hernández-Andreu, 2019).

To address these governance gaps, a range of soft law instruments—valued for their flexibility and adaptability—have emerged and can be grouped into two categories: those promoting responsible research practices, and those offering regulatory and policy guidance. The World Health Organization (WHO), for example, addresses dual-use concerns through initiatives such as the "Responsible Life Sciences Research for Global Health Security" project, with particular emphasis on the potential misuse of synthetic biology to recreate eradicated pathogens like smallpox. Similarly, the World Organisation for Animal Health (OIE) issued guidelines in 2019 to help veterinary researchers identify and manage dual-use risks. On the policy side, the International Risk Governance Council (IRGC) provides strategic guidance for governments in managing biosecurity risks associated with synthetic biology. Another informal mechanism, the Australia Group, reinforces global biosecurity by coordinating export controls on dual-use technologies and supporting capacity-building efforts (Sun et al., 2022), thereby filling gaps left by the BWC, which does not address export control issues (Gómez-Tatay & Hernández-Andreu, 2019). These soft law mechanisms do not replace the BWC but help operationalize its intent in areas beyond the scope of formal treaty instruments.

In sum, the global governance of synthetic biology bifurcates into biosafety and biosecurity dimensions, each involving distinct primary concerns, legal institutions, and legal natures. Table 1 summarizes these core differences.

Table 1: The Global Governance System of Synthetic Biology

Dimension	Biosafety	Biosecurity
Primary Concern	Preventing accidental risks	Preventing intentional misuse
Lead Institutions	CBD Secretariat and subsequent protocols, WHO	BWC, WHO, OIE, Australia Group
Legal Nature	Binding treaty foundation (CBD, Cartagena Protocol) with soft-law supplements	Hard law (BWC) exists but lacks enforcement; relies heavily on soft-law

Source: Compiled by the author based on Lai et al. (2019) and CBD (2022).

3.3 Challenges and Prospects of Synthetic Biology Global Governance

Despite their different focuses, both dimensions confront at least three common challenges:

Current international governance frameworks relevant to synthetic biology—primarily the Convention on Biological Diversity (CBD) and the Biological Weapons Convention (BWC)—were not originally designed for this domain, but rather extend pre-existing regimes focused on biodiversity conservation and biological weapons control. As the field evolves through advances such as gene synthesis and genome editing, many emerging risks fall beyond the original mandates of these instruments. Both biosafety and biosecurity governance thus face a common challenge: difficulty keeping pace with rapid scientific and technological change. The infrequent convening of decision-making bodies—biennially for the CBD and every five years for the BWC—combined with limited engagement with the scientific community, impedes adaptive governance (Keiper & Atanassova, 2020). Although scientists often adopt a more optimistic view of synthetic biology, governance responses remain cautious and disconnected from internal scientific developments. As noted by the CBD (2022, p. 150), a more integrated, forward-looking framework is urgently needed to address the field's novel risks.

Second, currently the global governance of synthetic biology - covering both biosafety and biosecurity - operates primarily through soft law mechanisms. The rapid innovation cycles and persistent uncertainties about risk profiles of synthetic biology make traditional hard law instruments, which demand stable technical parameters and predictable impacts, fundamentally ill-suited for effective governance. This is evidenced by the reliance on non-binding CBD guidelines for biosafety or BWC consensus measures for biosecurity, contrasted with the absence of treaty-based mandatory rules. Governance requirements vary according to the developmental stage of a technology. Early stages typically depend on flexible soft law mechanisms to promote knowledge-sharing and the establishment of norms, whereas later stages demand technical harmonization efforts, including standardized risk assessments, which are frequently constrained by the emerging nature of the field. Moving forward, governance must evolve through adaptive frameworks that can transition from consensus-building soft law to targeted hard law components as specific applications reach sufficient technological maturity, while maintaining flexibility for continuous innovation.

Third, the governance of synthetic biology faces a fundamental collective action problem rooted in the asymmetric distribution of technological capabilities. Developed nations prioritize innovation-friendly governance for synthetic biology, while developing countries demand strict biosafety/biosecurity rules and equitable benefit-sharing, reflecting a divide between technological advancement and risk prevention (CBD, 2022). This asymmetry perpetuates a governance deadlock: high-capacity actors prioritize maintaining their competitive edge, while low-capacity states remain vulnerable to unmitigated risks without meaningful access to benefits. The resulting impasse mirrors classic collective action dilemmas in global governance, where concentrated interests outweigh diffuse concerns, ultimately leading to suboptimal regulatory outcomes for all parties. This dynamic is

particularly acute in synthetic biology given its dual-use nature and high barriers to technological participation (Rabitz, 2025).

4. China's Role in Synthetic Biology Global Governance: The Tianjin Biosecurity Guidelines

The Tianjin Biosecurity Guidelines for Codes of Conduct for Scientists (hereinafter as 'Tianjin Biosecurity Guidelines' or simply 'the Guidelines') represent the first international biosecurity initiative named after a Chinese city and primarily driven by a Chinese proposal. The Guidelines advocate for responsible biological research and encourage governments and research institutions around the world to strengthen both regulation and self-discipline. The goal is to ensure that advancements in the biological sciences benefit humanity by preventing their misuse. Serving as a strong model for national and institutional biosecurity governance, the Guidelines set out 10 guiding principles and standards of conduct, which cover multiple aspects—including scientific responsibility, dissemination of research findings, science communication, and international collaboration. The Guidelines call for enhancing biosecurity awareness among researchers.

The Tianjin Biosecurity Guidelines was inspired by the Hague Ethical Guidelines which were developed by the Organization for the Prohibition of Chemical Weapons. Originating from a working paper jointly submitted by China and Pakistan to the BWC Eighth Review Conference in 2016, the Tianjin Biosecurity Guidelines were developed by Tianjin University Center for Biosafety Research and Strategy, Johns Hopkins Center for Health Security and the Interacademy Partnership. In 2018, during an international workshop on 'Building a Global Community of Shared Future for Biosecurity: Development of a Code of Conduct for Biological Scientists' co-hosted by the BWC Implementation Support Unit, Ministry of Foreign Affairs of China and Tianjin University, the former Chair of the BWC Meetings of State Parties Mr. Ljupˇco Jivan Gjorgjinski proposed naming the initiative the 'Tianjin' proposal, in recognition of the successful organization of the workshop and Tianjin University's contributions. Following this, experts from Tianjin University were regularly invited to report on the proposal's progress at the BWC Meetings of Experts (Wang, Song & Zhang, 2021).

Heading towards the official certification, Tianjin University, Johns Hopkins University and IAP representatives co-hosted two virtual workshops in 2021 April and May, which invited more than 20 scientists from 16 countries across 4 continents to participate. As a result, the IAP formally endorsed and certified the Guidelines on July 7, 2021. This endorsement has encouraged IAP member academies and other scientific organizations to disseminate the Guidelines more broadly, including efforts underway to leverage the regional networks of the International Science Academies (Wang, Song & Zhang, 2021).

Since the certification of the Tianjin Biosecurity Guidelines, it has achieved worldwide recognition. At the international level, first, the Youth Declaration for Biosecurity, launched by the United Nations Office for Disarmament Affairs (UNODA) in 2021, calls for youth engagement in global biosecurity and explicitly endorses the Tianjin Biosecurity Guidelines as a key framework for responsible scientific

conduct, reflecting its recognition by the international youth community. Second, the Tianjin Biosecurity Guidelines have been incorporated into the Global Guidance Framework for the Responsible Use of the Life Sciences published by WHO in September 2022. The WHO document aims to guide countries and stakeholders in strengthening the governance of dual-use biological research and raising awareness to reduce biosafety risks. Third, International Union of Biochemistry and Molecular Biology (IUBMB), an international non-governmental organization devoted to promoting research and education in biochemistry and molecular biology throughout the world, has listed the Tianjin Biosecurity Guidelines as Biosecurity Guideline on its website , praising it as 'high-level principles that serve as a reference for a broad range of stakeholders to develop or amend national- or institutional-level codes of conduct, practices, protocols or regulations'. In November 2022, during a side event of BWC 9th Review Conference, Mr. Daniel Feakes, then head of the Implementation support Unit (ISU) of the BWC and secretary-general of the BWC 9th Review Conference, stated that 'the Tianjin Biosecurity Guidelines sets an example for the international scientific community to promote and strengthen the role of the BWC and has been fully discussed and highly endorsed by the BWC process.'

At the domestic level, Pakistan, Brazil, Russia, the Philippines and Cuba, spoke in support of the Tianjin Biosecurity Guidelines and thought highly of the leading role China played. Brazil co-sponsored the Guidelines during the side event of BWC 9th Review Conference. Dr. Peter McGrath, then the IAP Secretariat, mentioned that Guidelines has been supported by more than 150 national institutions, which reflects the consensus of the international scientific community.

Namdeo and Zhang (2024) characterize the Tianjin Biosecurity Guidelines as a form of Track II science diplomacy—diplomacy through unofficial and non-governmental channels—which serves as an important soft law instrument in the global governance of biosecurity. The Tianjin Biosecurity Guidelines address a longstanding gap in the global governance of synthetic biology: the limited involvement of scientists in regulatory frameworks. Prior to the Ninth Review Conference of the BWC, scientists from countries including the United States, China, South Africa, and Italy jointly advocated for the endorsement of the Tianjin Biosecurity Guidelines for Codes of Conduct by the BWC, aiming to promote responsible scientific conduct and enhance global biosecurity governance (Gronvall, etc al, 2022).

Grounded in their alignment with the principles of the BWC, the Tianjin Biosecurity Guidelines seek to prevent the misuse of biological research. Complementing the BWC's hard-law framework, the Tianjin Guidelines operate as soft law and fill the critical gap of scientific community engagement in biosecurity governance. As a non-binding instrument, the Guidelines function as a developmental governance tool that fosters consensus on research practices and regulatory approaches amid the rapid evolution of synthetic biology. In advancing the Tianjin Biosecurity Guidelines, China has assumed a bounded revisionist role in the global governance of synthetic biology—promoting normative innovation through soft-law mechanisms within the existing international order rather than contesting hard-law foundations.

5. Conclusion

The governance of synthetic biology remains an ongoing challenge due to the field's disciplinary complexity and rapid development. Using the institutional design framework of global governance with the 'status quo vs. revisionist' framework from international political economy, this study analyzed China's role in the global governance of synthetic biology. In this context, the Tianjin Biosecurity Guidelines contribute to biosecurity risks governance, one of the two risks synthetic biology faces. The Guidelines complement deficiency in the BWC by incorporating perspectives from scientists across countries, an approach which is so far neglected in the global governance of synthetic biology. The promulgation and global promotion of these guidelines exemplify China's active effort to shape soft norms and ethical standards in the realm of global biosecurity governance beyond the BWC, which makes China a bounded revisionist, a power that operates within the existing system while selectively seeking to reshape aspects of it. This resonates with China's bounded revisionist behavior in hard law domains such as ICT governance, suggesting a consistent pattern in how China engages with the global governance of emerging technologies. Instead of fundamentally opposing the existing order, China works within it to advance incremental reforms, both in soft laws and hard laws. This sheds light on China's evolving role in the global governance of emerging technologies and the shifting dynamics of global governance more broadly.

The recognition and diffusion of the Tianjin Biosecurity Guidelines also serve to decenter a traditionally Western-dominated discourse on biosecurity. As Namdeo and Zhang (2024) note, biosecurity governance has long been driven by the US and European countries. China stands out as the first non-Western country to issue a global guideline aimed at shaping soft-law governance in this field.

Global technology governance represents a relatively nascent research domain within international relations studies. Given the inherent complexity and rapid evolution of emerging technologies, their governance systems necessitate multidimensional analysis. This study, while proposing three principal research dimensions, primarily examines China's role in the global governance of synthetic biology through the hard law/soft law lens. However, research remains insufficient regarding the dimensions of centralization and scope. Future research could be advanced along three trajectories: first, exploring China's engagement patterns in other emerging technology governance regimes; second, delving into the underlying determinants of China's specific policy stances; third, employing comparative analysis to systematically examine the convergence and divergence between China's positions in global technology governance, global economic governance, and global environmental governance, etc. Such endeavors would contribute to a more theoretically grounded understanding of China's evolving role in the contemporary global governance systems.

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Author Contributions

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Availability of Data and Materials

Data availability is not applicable to this article as no new data were created or analyzed in this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest to report regarding the present study.

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