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Global Landscape of Climate Change Response, Chinese Practices, and Financial Challenges

Linyu Zhang *, Wenjing Du

School of Management, Chongqing University of Technology, Chongqing, China
*Corresponding Author: Linyu Zhang

ABSTRACT

This study examines advancements in addressing climate change on an international scale, with a particular focus on initiatives undertaken in China, while also identifying the fiscal and funding obstacles that have emerged throughout these efforts. The study finds that although a global climate governance framework centered on the Paris Agreement has been established, it faces structural dilemmas such as intensifying geopolitical rivalry and a "deadly gap" between emission reduction actions and temperature control targets. China's pursuit of its "dual carbon" targets, supported by the overarching "1+N" policy framework, has yielded substantial progress in sectors such as renewable energy and electric vehicles. This approach reflects a transition strategy oriented toward fostering sustainable economic growth. However, global climate action is severely constrained by funding, with the scale of finance falling far short of requirements and exhibiting structural imbalances between mitigation and adaptation efforts, as well as across different regions. The conclusion points out that the future success of global climate governance hinges on bridging three critical divides—political, implementation, and financial—by driving reforms in the financial system and fostering substantive international cooperation.

KEYWORDS

Climate Change; Global Climate Governance; Sustainable development

1. INTRODUCTION

Global climate change stands as one of the most significant challenges confronting humanity today. Research by Haider et al. (2019) indicates that climate change may increase the frequency and severity of forest fires and also negatively impact human health [1]. The United Nations Framework Convention on Climate Change (UNFCCC) characterizes climate change as alterations in the Earth's atmospheric composition and corresponding climatic patterns over time. These changes, which are linked directly or indirectly to human actions, exceed the scope of natural climatic fluctuations observed over similar durations. The Synthesis Report of the Sixth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC) underscores the critical and immediate necessity for worldwide efforts aimed at both mitigating climate change and enhancing adaptive capacities [2]. Recognizing this issue as a primary challenge of the 21st century, immediate and sustained collective action is required at multiple scales [3].

However, a vast gap persists between the ambitious institutional blueprint and the stark reality of concrete action. Despite accelerated transitions to renewable energy and increasing engagement from non-state actors, the United Nations Environment Programme (UNEP) reports that even with the full implementation of current national pledges, global temperatures remain on track to rise far beyond safe thresholds.Underlying this "action gap" is an increasingly complex global political and economic

landscape: climate issues have become deeply intertwined with major power competition, industrial policies, and trade rules, eroding the common ground for international cooperation. Moreover, the substantial financial resources required to advance the green transition are confronted with a pronounced funding shortfall, compounded by a markedly uneven distribution of capital.

Against this backdrop, a systematic examination of the evolutionary logic of global climate governance, an analysis of the transition pathways of major economies, and a diagnosis of the constraints within the financial support system hold significant theoretical and practical importance. This paper aims to construct an integrative analytical framework. The first section provides an analytical overview of developments in worldwide climate governance since the adoption of the Paris Agreement, examining key geopolitical influences and persistent institutional constraints that have shaped this period. Second, taking China as a typical case, it analyzes the practice and paradigm of how the country has internalized its "dual carbon" goals into its national development strategy and drives systemic transformation through industrial revolution and policy innovation. Lastly, with a specific emphasis on climate finance as a critical limiting factor, this analysis uncovers the fundamental tensions arising from its systemic inadequacy and uneven distribution across sectors and regions. Through this tripartite cross-analysis, this paper seeks to uncover the core obstacles that must be overcome to advance global climate change response from political commitment to tangible action, and to provide an academic reference for promoting a just, effective, and resilient global transition.

2. GLOBAL GOVERNANCE: PROGRESS, CONTESTATION, AND GAPS

Currently, global climate change response has entered the "post-Paris era" centered on the Paris Agreement, characterized by a more rigid compliance mechanism, the intensification of climate politics as a site of deep contestation, and a diversification of governance actors. While the international community has made significant progress in areas such as institutional building, emission reduction actions, and financing cooperation, it simultaneously faces structural dilemmas, including heightened geopolitical rivalry, a substantial action gap, and persistent equity challenges.

Within the framework of international organizations, the architecture of global climate governance has developed into a regime centered on the UNFCCC. This regime has progressed through distinct phases, notably marked by the implementation of the Kyoto Protocol and the subsequent establishment of the Paris Agreement [4]. This marks the gradual maturation of the legal framework and collective action mechanism for the international community's response to climate change. The Paris Agreement introduced mechanisms such as "Nationally Determined Contributions" (NDCs) and the "Global Stocktake" process, signifying a governance shift from top-down mandatory allocations to a hybrid model combining bottom-up commitments and review, thereby enhancing inclusivity and flexibility. As of September 9, 2024, 168 countries had submitted updated NDCs. These commitments collectively form the foundation of current global climate action. However, based on their developmental stages, resource endowments, and economic structures, countries exhibit highly divergent policy pathways and progress in implementation.

The European Union, through its "Fit for 55" package, is committed to achieving climate neutrality by 2050 via an economy-wide Emissions Trading System (EU ETS), the Carbon Border Adjustment Mechanism (CBAM), and stringent sectoral legislation. This strategy aims to translate climate ambition into trade and industrial rules with external influence, thereby consolidating its normative leadership. The United States is driving its domestic green transition through large-scale industrial policy under the Inflation Reduction Act. Leading emerging markets have affirmed their intention to strengthen the ambitions outlined in their Nationally Determined Contributions. Concurrently, these nations consistently foreground principles of equitable climate action and the imperative of sustaining developmental progress. Their policy focus lies in scaling up renewable energy while ensuring energy access and economic affordability. These divergent pathways reflect the complex interplay of historical responsibility, developmental stages, and geopolitical interests.

Regarding tangible advancements in emissions abatement, the falling costs of renewable energy technologies and their significantly growing deployment, combined with the swift global proliferation of electric vehicles, collectively indicate that a critical threshold of technical and economic viability has now been attained. A 2024 report by the International Energy Agency (IEA) indicates that renewable energy's share of global electricity generation has reached 32% and is projected to rise to 43% by 2030. Crucially, the share of variable renewable energy (VRE), primarily wind and solar, is set to jump from the current 15% to 28% by 2030, becoming the core driver for decarbonizing the power system. However, a "deadly gap" persists between global action and the temperature control goals of the Paris Agreement. The United Nations Environment Programme's 2023 Emissions Gap Report unequivocally states that even with the full implementation of all current national pledges, global warming is still projected to reach 2.5–2.9°C by the end of the century, far exceeding the safe threshold [5]. This shortfall is especially evident in sectors where emissions are difficult to reduce, including industrial production, construction, and agricultural operations. The situation is further exacerbated by a pronounced lack of dedicated funding for initiatives aimed at climate adaptation. More critically, the climate agenda is increasingly being instrumentalized. Subsidies initiated by the U.S. Inflation Reduction Act, and the ongoing realignment of supply chains for essential minerals all illustrate how leading economic powers are increasingly integrating climate-related measures into their core frameworks of economic security and geopolitical planning. While this may stimulate green investment in the short term, it risks exacerbating trade friction, eroding the principle of "common but differentiated responsibilities," and imposing new green trade barriers and transition cost pressures on developing countries in the long run.

Climate finance, serving as a pivotal pillar for global climate action, currently confronts formidable challenges in its developmental trajectory. While the developed countries' commitment to mobilize USD 100 billion per year in climate finance is nearing its target, the actual structure and distribution of these funds remain unbalanced. The mobilization of private capital, meanwhile, is constrained by perceived risks, underdeveloped project pipelines, and uncertainties in policy signals. The establishment of a "loss and damage" funding mechanism, agreed upon during the 27th Conference of the Parties (COP27) to the United Nations Framework Convention on Climate Change in 2022, constitutes a critical advancement in the pursuit of climate justice. This agreement represents a pivotal evolution within the global institutional architecture for addressing climate change. However, the specifics regarding its funding scale, sources, and operational mechanisms remain to be finalized, underscoring the political contestation within the international community over the assumption of historical responsibility.

Looking ahead, the future trajectory of global climate governance is approaching a decisive inflection point. On one hand, the scientific consensus is solidifying, technological solutions are maturing, and space is being created for engagement by non-state actors (cities, corporations, financial institutions). On the other hand, intensifying major power competition, frequent geopolitical conflicts, the rise of right-wing political forces, and economic uncertainties are eroding the political foundation for multilateral cooperation. As research indicates, while global awareness of adaptation has significantly increased, knowledge remains fragmented and policy-making approaches are inadequate, particularly lacking vertical and horizontal integration across stakeholders and regions [6]. True advancement will not rely solely on the revision of commitments, but rather on the capacity to overcome geopolitical fragmentation, create verifiable frameworks for financing and technological assistance, guarantee an equitable shift, and consequently transform competitive pressures into a unified driver of international cooperation.

3. THE CHINESE APPROACH: STRATEGY, INDUSTRY, AND TRANSITION PATHWAY

Since 2010, the impact of climate risks on China has shown an upward trend [7]. As the world's largest developing country and carbon emitter, China's approach to climate change response has transcended the singular issue of emission reduction, evolving into a profound systemic transformation of its economy and society. This pathway is characterized by distinct strategic planning, industrial dynamism, and a development-centric orientation. China's climate policies exhibit unique features and specific advantages within its distinctive socialist market economy [8]. Since formally announcing the dual goals of achieving carbon peak before 2030 and carbon neutrality before 2060 ("dual carbon" goals) in 2020, China has rapidly established the world's largest and most extensive policy system and industrial ecosystem for low-carbon transition. These actions become a pivotal force in reshaping the landscape of global climate governance.

China's approach to climate governance is propelled by a robust and coherent national strategic commitment, which operationalizes high-level policy frameworks into implemented measures via its integrated "1+N" policy architecture. This system, guided by overarching national-level plans, encompasses key sectors such as energy, industry, transport, and construction, ensuring vertical alignment in target implementation and horizontal coordination across departments [9]. At its core lies the treatment of "energy security" and "economic stability" as non-negotiable constraints for the transition. This has shaped a pragmatic pathway best described as "guarantee first, transformation follows." This pragmatic approach is most evident in the energy sector, where China has achieved transformative success in renewable energy. By the conclusion of May 2025, the aggregate installed capacity for wind and solar power generation in China had already surpassed the 1.2 billion kilowatt target set for 2030, achieving this milestone more than five years ahead of schedule. The share of non-fossil energy consumption in primary energy consumption reached 19.8% in 2024, while the share of coal consumption dropped significantly from 72.5% in 2007 to 53.2% in 2024. China is not only the world leader in installed clean energy capacity but, with its commanding share of global manufacturing capacity—approximately 80% for solar PV modules and 70% for wind power equipment—has also profoundly reduced the cost of green technologies worldwide, generating a significant spillover effect on the global energy transition.

Within industrial production and transportation systems, a shift toward environmentally sustainable practices is now progressing with remarkable breadth and speed, marking a significant acceleration in the pace of change. China has become the world's largest producer and consumer market for new energy vehicles (NEVs). By 2025, the national NEV fleet had exceeded 31.4 million units, with its production and sales accounting for over 60% of the global market share. The "new three" represented by NEVs, lithium batteries, and photovoltaic products have become a new driving force for China's foreign trade growth, signifying an endogenous synergy between green industrial competitiveness and emission reduction action.Simultaneously, the national carbon emissions trading market (ETS), a crucial market-based mechanism, has been operating smoothly. According to data released by pertinent authorities, the national carbon emissions trading scheme, functioning as a principal market-based regulatory instrument, is operating with stability. This established operational foundation serves as a necessary precondition for subsequently expanding its sectoral coverage and developing a carbon pricing mechanism capable of exerting tangible market influence.

China's philosophy and practice in addressing climate change contribute a distinct "development" paradigm to global climate governance. Differing from pathways that emphasize emission reduction constraints alone, China advocates a "development-centric" approach, prioritizing the integration of mitigation, adaptation, and the right to development within a sustainable development framework. This paradigm extends beyond industrial and energy transitions, actively shaping finance and technological innovation. For instance, research by scholars such as Dong and Yu demonstrates how integrating green finance with blockchain technology has effectively advanced emission reduction,

highlighting the supportive role of financial innovation in the broader transition [10]. This pathway resonates with the aspirations of numerous developing countries for a just transition. At the international level, China firmly upholds the Paris Agreement and the principle of "common but differentiated responsibilities." For example, China has signed 55 climate-related South-South cooperation documents with 43 developing countries and aids in enhancing global climate resilience through initiatives like building low-carbon demonstration zones and providing early warning systems.

However, China's transition pathway faces profound challenges. First, the "trilemma" of energy security, cleanliness, and affordability remains acute. Looking ahead, the foundational role of coal within the overall energy mix is expected to persist, presenting significant challenges for its rapid displacement. Concurrently, the enhancement of flexible regulation capabilities during the transition towards a new power system paradigm remains a protracted and demanding endeavor.Second, regional and sectoral development is uneven. Regions and industries with heavy industrial bases face significant transition costs and social risks, highlighting the need for stronger just transition mechanisms. Finally, facing green trade barriers like the EU's CBAM, China must swiftly establish an internationally aligned carbon footprint system and strengthen its influence over global green rules.

Moving forward, China's climate progress will shift from scale expansion to systemic deepening. The core task lies in promoting deep adaptation and innovation within the energy, industrial, financial, and governance systems, particularly by achieving breakthroughs in key technologies such as new-type energy storage, green hydrogen, and carbon capture, utilization, and storage. China's low-carbon transition demonstrates that a mega-economy's shift is not zero-sum, but can drive new industries and growth. Its success is vital for global climate goals and offers emerging economies an ambitious yet practical model distinct from traditional carbon-intensive development.

4. THE FINANCIAL CHALLENGE: THE FUNDING GAP AND SYSTEMIC TRANSFORMATION

Cities worldwide are becoming increasingly vulnerable to the impacts of climate change, yet their capacity to attract private finance for urban climate adaptation remains limited [11]. This reveals a core dilemma in global climate governance: the pronounced and growing disparity between aspirational climate strategies and the capital required to implement them. Existing climate finance remains inadequate to meet the systemic investment necessary for fulfilling the Paris Agreement's temperature objectives. Therefore, evaluating financial needs constitutes a central aspect of assessing worldwide climate action.

In terms of aggregate volume, the financial requirement is astronomical, while actual flows fall severely short. To achieve the goal of limiting global warming to within 1.5°C, estimates from institutions like the International Energy Agency (IEA) indicate that annual global investment in clean energy needs to surge rapidly to approximately USD 4.5 trillion per year by 2030. According to the Global Landscape of Climate Finance 2025 report published by Climate Policy Initiative (CPI), global climate finance saw significant expansion during the 2021-2023 period, with an average annual growth rate of 26% [12]. This growth trend reflects an accelerated pace of financial commitment to global climate action. Nevertheless, current funding levels remain far below the annual trillions of dollars in investment necessary to achieve the temperature targets set by the Paris Agreement. Furthermore, the report notes that public climate finance declined by approximately 13% between 2022 and 2023, constrained primarily by domestic government budgets. As the need for climate adaptation grows more urgent, the essential role of sufficient funding has gained broad recognition [13].

A deeper structural issue, however, lies in the uneven allocation of capital—revealing a systemic inadequacy of existing financial systems in addressing climate needs, especially those related to

adaptation. First, there is a severe imbalance between mitigation and adaptation finance. Over 90% of tracked climate finance flows to mitigation sectors such as renewable energy generation, while adaptation finance—directed towards enhancing the climate resilience of vulnerable communities, agriculture, and water systems—constitutes a minuscule share, with its annual flows amounting to less than one-tenth of mitigation finance.

Second, the geographical distribution of funds is highly uneven. The vast majority of investments are channeled into large-scale projects in markets with maturity and clear returns, predominantly concentrated in China, the United States, and the European Union. In stark contrast, the Least Developed Countries (LDCs) and Small Island Developing States (SIDS), which face the most severe climate impacts and possess the weakest adaptive capacity, receive funding that is grossly inadequate relative to the extreme risks they confront, thereby exacerbating global inequalities in climate vulnerability.

Finally, both the catalytic role of public finance and the participation of private capital remain insufficient. The persistent shortfall by developed nations in delivering the pledged annual $100 billion in climate finance to developing countries by 2025 has significantly undermined international political trust. Concurrently, private capital remains largely absent from the adaptation sector and many frontier mitigation technologies, deterred by perceived high risks, low returns, and underdeveloped financing mechanisms. Traditional financial institutions' risk-pricing models also struggle to effectively incorporate long-term climate risks.

This current state underscores the inherent limitations of the existing global climate finance architecture. It remains overly reliant on a limited number of channels and traditional project-finance models, ill-suited to address decentralized, localized adaptation needs and incapable of effectively pricing complex climate risks. International financial institutions, such as multilateral development banks, must reform their capital and risk frameworks to attract large-scale, affordable private finance. The central challenge now is whether a strong, efficient, and inclusive financial public good can be built to support a just global transition. Without deep financial system reform, neither technology nor political pledges can deliver on climate goals, leaving ambition and action permanently disconnected.

5. CONCLUSION AND PROSPECTS

The global response to climate change has transitioned from a "pledge era" of declaring ambitions to an "action era" of demonstrating tangible results. The analysis in this paper reveals a global landscape fraught with tension and dynamic evolution: while institutional frameworks are becoming more robust and techno-economic tipping points have been reached, the fissures of geopolitics, the deadly gap between ambition and action, and the shortcomings of the financial system underpinning the transition collectively constitute the most severe structural challenges of our time.

First, while global climate governance has achieved a historic construct institutionally, its political consensus is under immense strain. The Paris Agreement’s flexible, bottom-up system cannot resolve deep divides over historical responsibility, development needs, and geopolitical interests. Major economies' different climate paths signal future disputes over global green rules and trade. Linking climate action with economic security may boost short-term investment but risks undermining multilateral trust and unfairly burdening developing countries.

Second, China's response offers a paradigm of major power transition driven by development and propelled by industry. Through the top-level design of its "dual carbon" goals and the vigorous implementation of the "1+N" policy system, China has achieved leapfrog development in areas such as renewable energy scale and the new energy vehicle industry. China's experience shows that the low-carbon transition of a mega-economy can systematically reshape its sources of economic growth.However, the challenges it faces—including the energy trilemma, regional disparities, and

international green trade barriers—also foreshadow the complexity and arduousness of the next phase of its transition.

Finally, and most critically, the transformation of the financial system is lagging severely behind the needs of the real-economy transition. The vast funding shortfall, highly uneven flow patterns, and inadequate mechanisms for mobilizing private capital together reveal that the current financial system has not yet been fundamentally reoriented to effectively support climate goals. Without a profound financial revolution, no technological blueprint or political declaration can be successfully implemented.

While the submission of a new round of Nationally Determined Contributions (NDCs) in 2025 represents a critical political juncture for testing whether the international community can collectively raise its ambition, genuine breakthroughs will hinge on the ability to bridge three fundamental divides:First, the political divide: channeling geopolitical competition into constructive technological rivalry and cooperation, while upholding the baseline of climate justice.Secondly, an implementation gap exists, signifying the challenge of effectively translating overarching policy commitments into concrete investments and reform actions across diverse sectors and industries. A critical focus must be placed on overcoming the barriers to emission reduction in high-emitting sectors such as industry and construction. Third, the financial divide: constructing a global financial public goods system that is sufficiently large-scale, efficient, and equitable to ensure that all nations, especially the most vulnerable communities, possess the capacity to both cope with impacts and undertake transition. Ultimately, addressing climate change is not merely an environmental or technological issue, but a profound transformation concerning global development models, economic governance systems, and the international cooperative order. Success will depend on humanity's capacity to harness unprecedented wisdom and collaboration, turning an imminent existential crisis into a historic opportunity to collectively advance towards a sustainable, inclusive, and resilient future.

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