

Chinese NGOs' engagement in trans-boundary renewable energy technology transfer

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ABSTRACT

Wider and effective adoption of renewable energy technologies (RETs), especially in developing countries, is critical for achieving carbon neutrality by 2050. China is now the new leader in RETs and plays an increasingly important role in trans-boundary technology transfer. Likewise, Chinese non-governmental organizations (NGOs) become more active internationally. Through in-depth analysis of three cases, we investigate Chinese NGOs' engagement in trans-boundary RET transfer and identify the needs and challenges. The results show that Chinese NGOs have played various roles, such as coordinating stakeholders, providing technical assistance and mitigating potential conflicts. However, barriers related to funding, policy and competency need to be removed before NGOs can play fuller roles. This study provides insights into the current dynamics and potentials of Chinese NGOs in technology transfer and has important implications for policy making, business strategies, and international NGOs community.

KEYWORDS

Non-governmental organizations (NGO), trans-boundary technology transfer, renewable energy technology, China.

1 Introduction

Latest studies show that it will be difficult to limit global warming to 1.5 °C unless drastic measures are taken to achieve carbon neutrality by 2050^[1]. In response, countries are committed to net-zero emissions and carbon neutrality, for which wide and effective adoption of climate and environmental technologies is critical. This commitment was further solidified at COP28, where over 110 nations pledged to triple their renewable energy capacity by 2030. Traditionally, developed countries are perceived as having the capacity and responsibility to transfer environmental technologies to other countries, particularly developing countries, to promote clean energy transition^[2]. The trends of globalization, informatization and digitization, changing geo-politics and global governance failure have dramatically changed all aspects of technology transfer and diffusion. Apart from traditional North-North and North-South technology transfer and cooperation, South-South cooperation has gained increasing importance for coping with climate risks. Global technology transfer has been flattened and decentralized^[3] in which China is an important game-changer.

At present, China is undergoing a transition from a recipient to a provider of climate and environmental technologies to other developing nations, and even to developed countries. China's renewable energy technology industry has experienced a significant surge, currently holding a dominant position in the global market. The Green Belt and Road Initiative was launched in 2017 to promote green and low-carbon development along the route. Since then, China has been expanding its renewable energy network to the global South by increasing climate finance and accelerating technology transfer^[4]. The traditional technology transfer mode, led by governments and market players, has been augmented by emerging agents, such as consulting organizations,

bridge organizations, and research institutions, which together form a complex network of technology transfer agents^[5]. Nevertheless, the process of technology transfer has encountered numerous risks and challenges, including political, financial, legal, environmental, and cultural ones^[6]. The traditional technology transfer mode is inadequate to fully address these challenges. To mitigate the potential conflicts and find innovative solutions, Chinese non-governmental organizations (NGOs) have begun to participate in renewable energy technology (RET) transfer and interact with Chinese technology enterprises, governments of recipient countries, local communities, and other stakeholders.

While the role of NGOs in environmental governance and technology transfer has been an old subject in English literature, it is an emerging but fast-growing field of inquiry for Chinese NGOs. Based on three case analysis, we aim to investigate Chinese NGOs' roles in the trans-boundary transfer of RETs. Trans-boundary technology transfer involves complex interactions between stakeholders from different countries and cultures. To understand the dynamics of RET transfer, we adopt a dynamic and interactive perspective to comprehend technology transfer process, addressing the following two research questions:

- 1) What roles do Chinese NGOs play in trans-boundary RET transfer at present, and how do they interact with enterprises, governments, local communities, and other stakeholders?
- 2) What barriers and challenges do Chinese NGOs face when participating in overseas renewable energy projects and expanding their reach globally?

The three cases—Institution G (a comprehensive NGO that directly implements technology transfer pilot projects), Institution L (a think tank focusing on industry research and policy advocacy), and Institution M (a bridge organization that empowers Chinese local NGOs and promotes cooperation between social organizations and

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enterprises) —were purposefully selected to represent three distinct types of Chinese NGOs engaged in trans-boundary RET transfer. By investigating the roles, barriers, and needs of these three Chinese NGOs in technology transfer, we aim to capture and respond to the growing participation of Chinese NGOs in trans-boundary RET transfer, thereby contributing to the knowledge base on NGOs' involvement in global environmental governance. Our research outcomes are anticipated to inform policy and practice, enabling NGOs to take on a more engaged and impactful role in enhancing the sustainability of overseas renewable energy investments and promoting the inclusive growth of host countries.

2 Chinese NGOs and climate technology transfer

2.1 Technology transfer studies

The concept of technology transfer was first introduced in the mid-1960s by the UN. Generally, technology transfer is defined as the process of transferring know-how about making and doing that is possessed within an organization to another organization for use^[7]. It consists of three fundamental elements: the process, the supply and demand sides of the technology, and the “interactions” between the supply and demand side. The nature of technology transfer makes it a challenging communication process, as it involves multiple stakeholders with differing languages, values, and motivations, exchanging objects from abstract concepts to concrete products and services^[8]. Moreover, technology transfer is entangled with technology invention and adoption, constituting the complex process of technology development.

In terms of trans-boundary technology transfer, the core debate in this field is how to achieve effective international technology transfer. In other words, how technology transfer is translated into actual technological capabilities in the host country. As Ockwell and his colleagues argued, academic responses fall into two groups^[9]. Some scholars argue that increased capital investment will enhance capacity building in developing countries and ultimately lead to successful technology transfer^[10]. Other scholars support the assimilation theory of technology transfer based on empirical studies^[11, 12]. They argue that knowledge transfer is the core of achieving effective technology transfer. It is extremely difficult to transfer tacit knowledge, which is an accumulation of practice, communication skills, and wisdom^[13]. Our research draws inspiration from this perspective, with a specific focus on the role of NGOs in facilitating the transfer and learning process of technology-related knowledge.

The globalization and informatization wave have expanded the scope, subjects, objects, and channels of trans-boundary technology transfer. The scope has evolved from one-way transfer among developed countries to two-way technology transfer on a global scale. The subjects have developed from the point-to-point mode to a multi-agent, comprehensive, and grid-based technology transfer ecosystem. The objects have evolved from a single technology product to a comprehensive solution covering hardware, software, and integrated with the specific contexts of local communities^[14, 15]. China plays a critical role in the development of the international technology transfer system. With its rapidly growing capacity for independent innovation, China has transformed from a follower to a leader in RETs^[16]. Currently, China has established world's most complete and competitive

industrial chain. Chinese photovoltaic (PV) companies possessed 79.4%, 96.8%, 85.1%, and 74.7% of the world's polysilicon, wafers, cells, and modules manufacturing capacity, respectively, in 2021^[17]. China is also a leading player in the wind power industry, with seven wind turbine manufacturing companies ranked among the top 10 globally. China leads in both onshore and offshore wind power technology^[18]. In 2021, It was announced that China would stop building new coal power projects overseas, further promoting the green transformation of China's overseas energy investments. The Green Belt and Road has established a platform for trans-boundary climate technology cooperation, bringing new opportunities and policy guarantees for technology transfer from China to emerging economies. China has collaborated with over 100 countries in the fields of photovoltaic, wind power, hydropower, and thermal energy, and the annual investment in renewable energy projects within countries and regions along the Belt and Road exceeds two billion US dollars^[19].

Trans-boundary technology transfer involves traversing diverse national contexts, including different political systems, cultures, languages, and resource endowments. It requires redefining the boundaries of governance and related subjects based on technology flows. In reality, technology transfer projects often encounter a lack of leadership, rules, and public services. Consequently, achieving effective trans-boundary technology transfer is challenging by solely relying on traditional government-led or market-led technology transfer. To ensure effective technology adoption in the host country, improving the acceptance of technology by local people is crucial. However, this is not a simple task^[3].

2.2 Climate technology transfer with dual externalities

Climate technologies are a broad category that includes both hard and soft technologies. Hard technologies refer to tangible items like equipment, devices, and tools, which are directly involved in climate-related activities. Soft technologies, on the other hand, involve intangible aspects such as organizational practices, skills, social capital, capacity building, and established norms. These two sides collectively cover the entire life cycle of a product, from design and production to its consumption and disposal^[20]. Furthermore, we define trans-boundary RET transfer as the process of transferring renewable energy technologies from one country to another in both non-commercial and commercial forms. This process includes learning, understanding, and utilizing technology, as well as the ability to adapt to local conditions and absorb tacit knowledge through communication.

Renewable energy technologies, such as wind, solar, and hydropower, are environmentally friendly and promote sustainable development by reducing pollution, protecting biodiversity, and cutting greenhouse gas emissions. The most notable feature of environmental technology transfer is its double externalities. Firstly, the environment and climate have externalities as public goods. When innovators adopt new technologies to improve overall environmental quality, the entire society reaps benefits. But the innovators bear the costs of technology development and transfer. Secondly, technology spillovers give rise to externalities. In the context of technology transfer, spillover refers to the situation where the benefits of a technology extend beyond the exporters and recipients, while the costs incurred by the innovators and promoters remain inadequately compensated. Consequently, this could lead to reduced levels of technological innovation in the private sector,

which cannot be solved with simply regulated and competitive market strategy. These double externalities imply that environmental and climate technology transfer and innovation are unlikely to succeed without the assistance of transnational and cross-regional organizations such as NGO.

Despite the rapid development of technical cooperation between China and the Belt and Road (BRI) countries, enterprises encounter numerous obstacles and challenges when investing in and developing renewable energy projects abroad. These challenges include a) political risks due to the instability and volatility of the host country's political environment, b) economic risks such as tax and exchange rate risks, c) cultural barriers resulting from differences in customs, language, religion, lifestyle, and values, d) legal risks like labor disputes with local employees in the host country and labor protection disputes^[21, 22]. While Chinese renewable energy projects exported to BRI countries have brought significant local benefits, if not managed properly during implementation, these projects could potentially impact the local environment and residents' livelihoods. To minimize any adverse effects and ensure the successful transfer of green technologies, Chinese companies need NGOs to coordinate stakeholders and help mitigate various types of risks. However, the role of NGOs in climate technology transfer has not been adequately discussed^[23, 24].

2.3 NGOs and climate technology transfer

NGOs are commonly defined as non-state organizations operating in the fields of international development, humanitarian action, and the environment, which are independent of for-profit enterprises^[25]. They have become key actors in implementing climate actions, mobilizing climate finance, framing climate issues, building broad alliances and strategically influencing national and international environmental policies^[26–28].

With the specialization of social organizations, NGOs of various types and backgrounds are involved in different aspects of environmental technology transfer. There are platform organizations, business associations, executing agency, and think tanks, participating in the entire process of technology development, including technology invention, transfer, and adoption. NGOs help introduce talents and funding needed for technology transfer, participate in technology evaluation, ease the relationship between enterprises and communities, and convey public demands^[29].

The role of NGOs in environmental governance and technology transfer has been extensively explored in English literature^[30–32], while in China, this field of inquiry is still in its nascent stage, yet rapidly developing. According to the Chinese Ministry of Civil Affairs, there were approximately 6 thousand ecological and environmental civil groups by the end of 2017 in China^[33]. The number of Chinese environmental NGOs has grown significantly over the past decade, increasing by approximately 40% from 2007 to 2017, reflecting heightened environmental awareness in Chinese society.

China's rise as a global development actor has led to the “going out” strategy, involving diverse actors such as state agencies, businesses, and NGOs. The objectives of Chinese NGOs and state policies jointly shape the way they “go out”^[34]. Initially, Chinese NGOs with official backgrounds, like the China Foundation for Rural Development, were among the first to extend their influence globally by undertaking government-funded technical assistance projects. Some researchers observed that Chinese NGOs had limited impact in Africa due to host countries' domestic politics

and regulatory frameworks, favoring temporary, one-off projects executed by government-organized NGOs rather than grassroots organizations^[35].

However, the situation is rapidly changing. Since 2015, Chinese NGOs have been significantly involved in RET transfers. As South-South cooperation deepens, Chinese NGOs are expanding their projects overseas, exerting international influence in trade, poverty alleviation, and environmental protection. They participate in global environmental governance through three modes of action: leveraging mechanisms like conferences, proposals, and social movements; providing support measures such as financial, technical, and managerial assistance; and pursuing long-term, market-based solutions. International NGOs (INGOs) also play a significant intermediary role in China's global strategy, providing resources and acting as bridges or initiators^[36].

Highlighting China's increasing involvement in global environmental governance, the UN Biodiversity Conference (COP15) and the UN Climate Change Conference (COP27) were significant milestones. As the presiding country of COP15, China facilitated the adoption of the “Kunming-Montreal Global Biodiversity Framework,” setting targets for global biodiversity conservation. At COP27, China submitted the “Progress Report on China's Implementation of Its Nationally Determined Contributions (2022),” demonstrating its commitment to addressing critical environmental issues. While China's government is advancing environmental governance, there is a growing international interest in the cases, perspectives, and experiences of Chinese civil society. Simultaneously, Chinese technology companies are beginning to engage with social organizations to ensure successful overseas projects. Consequently, both the government and enterprises are placing greater emphasis on the important roles that NGOs play in international contexts.

3 Research design

3.1 Analytical framework

Drawing on the conceptual definition and literature review presented above, we construct an analytical framework to investigate how Chinese NGOs interact with other actors during trans-boundary technology transfer and the roles they play at different stages of technology development (see Figure 1). From domestic to international levels, Chinese NGOs engage with governments, enterprises, the public, and other organizations in both technology exporting and recipient countries. Furthermore, technology transfer is an integral part of the technology development process, intertwined with technology invention and adoption, and must be analyzed in conjunction with these two.

3.2 Research methods

We employ a qualitative approach to investigate the interaction process between Chinese NGOs and other actors as well as significant events concerning Chinese NGOs in trans-boundary RET transfer. With the analytical framework, we analyze the roles of Chinese NGOs play in technology transfer, the challenges they encounter, and their potentials for future development.

We utilized rigorous data collection and analysis methods, specifically in-depth interviews and case studies. Semi-structured interviews were conducted in 2020 and 2022 with experts and senior program officers from Chinese NGOs. We had five key informants who are senior officials with extensive experience

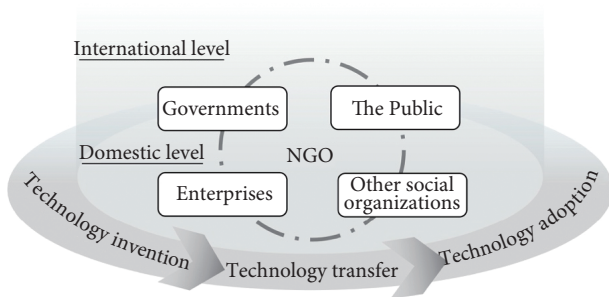


Fig.1 Analytical framework for NGOs in trans-boundary climate technology transfer.

related with cross-border RET transfer. The interviews covered three main topics: the current status of the Institution's technology transfer projects, the roles and challenges faced by Chinese NGOs in RET transfer, and strategies for optimizing the potential of Chinese NGOs in RET transfer. To gain additional insights from the perspective of technology companies, we conducted interviews with representatives from two leading Chinese firms—a wind power company and a photovoltaic company. Additionally, since 2020 we have been systematically collecting and analyzing secondary data to supplement and verify the interview data. This dataset includes over 20 research reports and more than 100 media articles, along with various relevant agreements, documents, and news pieces. The organizations involved in the study have been anonymized to protect their privacy.

For case selection, through preliminary literature review, expert interviews with officials from international NGOs, and media reports analysis, we found very few organizations consistently engage in trans-boundary RET transfer. Among them, Institution G, Institution L, and Institution M stood out based on their distinct yet complementary roles and over 10 years of direct and indirect participation in this area. Consultation with senior experts confirmed that these three organizations are at the forefront of RET transfer projects and serve as the most suitable and representative cases for analysis.

4 Analysis of Chinese NGOs in trans-boundary RET transfer

In the trans-boundary transfer of RETs, Chinese NGOs play a crucial role in handling international affairs, civil society diplomacy, and multi-party cooperation. Despite the rapid development of South-to-South technology cooperation, RET transfer faces various risks and barriers. During the whole process of technology invention, transfer and adoption, technology companies need the assistance of NGOs to coordinate stakeholders and mitigate potential environmental, social, and economic risks. This section delves into three specific case studies that illustrate how Chinese NGOs engage in trans-boundary RET transfer processes, discussing their unique characteristics, distinctive roles, challenges faced, and various interactions with stakeholders.

4.1 Institution G

4.1.1 Overview

Institution G is an NGO founded in 2004 with a primary focus on sustainable rural development, biodiversity conservation, energy

transition and climate change, environmental governance, and international cooperation. Since 2009, Institution G has initiated over 20 projects aimed at promoting the transfer of RET in Southeast Asian regions, including Vietnam and Myanmar. These initiatives included organizing technology exchanges and training, building information exchange networks, and guiding enterprises to invest abroad. As a result, Institution G has acquired extensive experience in facilitating the diffusion, transfer, adoption, and application of RETs.

One notable project is the "Myitsone Hydropower Station Stakeholder Exchange and Community Development" initiative, conducted with China Power Investment Corp in 2015. After Myanmar halted the Myitsone Hydropower Station, Institution G facilitated discussions on the project's impacts, convening a closed-door meeting in Yangon with government officials, academia, and NGOs. This highlights Institution G's role in engaging with host country governments and local NGOs to mediate and build trust. In 2015, Institution G personnel conducted field research in Myanmar to gather local residents' opinions on the Myitsone Hydropower Station's cessation, its consequences, and current and potential alternative livelihood options in the area. This project provided recommendations for local economic development, demonstrating Institution G's commitment to understanding and integrating local community needs. Moreover, in 2019, Institution G organized the "ASEAN-CHINA Cooperation on Energy Transition and Climate-resilient Development" conference to foster collaboration on renewable energy policies, planning, technology exchange, and investment between China and Association of Southeast Asian Nations (ASEAN) countries. This event illustrates Institution G's role in facilitating high-level dialogues and policy advocacy among regional stakeholders. (See Table A1 in the Appendix for details on this Institution's projects.)

4.1.2 Roles and functions

Throughout the process of innovation, transfer, and adoption of renewable energy technologies (RETs), Institution G serves a three-fold role:

Advocate for RETs and disseminator of related information.

Since 2009, Institution G has engaged in climate change and energy transition governance. For instance, in December 2009, it held a side event in Copenhagen to accelerate technology diffusion. Through organizing international dialogues, the Institution urges all social actors to pay attention to energy transition and RETs. It has also built a platform for technology cooperation and information exchange, seeking support in terms of information, funds, equipment, and technology from international institutions and financial entities. Additionally, Institution G continuously sends personnel to participate in relevant technology transfer training to promote invention and innovation.

Coordinator and matchmaker between technology suppliers

and users. On the one hand, Institution G leverages its professionalism and flexibility to research the needs of local communities, provide technical support and training to host countries, build a communication platform, and provide valuable feedback to Chinese enterprises. These efforts collectively serve to advance the global reach of China's renewable energy technologies. For instance, the organization organized a "Rural Renewable Energy" workshop that was attended by over 60 participants from the Ministry of Energy, Ministry of

Environmental Conservation and Forestry, Ministry of Electric Power of Myanmar, local NGOs, and renewable energy enterprises. This workshop promoted renewable energy infrastructure services in Myanmar. On the other hand, Institution G has also focused on building trust with the host government. In 2012, the organization invited the Myanmar government to visit Chinese energy enterprises and economic development zones in China. This visit provided the Myanmar government with insights into China's renewable energy technologies and helped clarify its technology needs. These activities highlight Institution G's role in bridging domestic enterprises with host country needs and fostering mutual understanding.

Pioneer and evaluator of technology implementation.

Institution G pioneered innovative renewable energy solutions in Thanbayarkhon Village, Myanmar, donating 193 clean stoves, 180 solar lamps, and a 1.1-kilowatt photovoltaic water pump to address water scarcity and electricity issues. The project's success demonstrated Chinese NGOs' role in cross-border RET transfer, garnering positive reactions from the government and local communities. Notably, it influenced the signing of a China-Myanmar agreement in 2017, referring to the donated materials in Institution G's project, confirming China's donation of 5,000 solar power systems and 10,000 clean biomass stoves to improve living conditions, increase energy supply, reduce deforestation and emissions, and promote cooperation. Institution G also conducted evaluation on the first anniversary, assisting the Chinese government in establishing a mechanism to ensure the effectiveness and sustainability of South-South cooperation on climate change. The study summarized experiences and lessons learned, proposing improvements. Its greatest sustainability lies in promoting Chinese enterprises "going out", as the aid products matched local demand and had high execution efficiency, recognized by the local government and market. This led to more international cooperation projects for Chinese enterprises and enhanced public understanding and use of renewable energy.

Despite its significant contributions to the innovation, transfer, and adoption of RETs, Institution G faces several challenges that hinder its efforts, including inadequate policy support, a lack of funding, difficulties in obtaining approval for establishing overseas office, and obstacles in cultivating enduring trust-building

mechanisms with host countries.

4.1.3 Interactions with stakeholders

As an environmental NGO with a global focus, Institution G collaborates with a wide range of stakeholders, including domestic governments, enterprises, financial institutions, research institutions, industry associations, media outlets, the public, international institutions, as well as local residents, civil society organizations and governments in host countries (see Figure 2). Within this extensive network, Institution G's guiding principles are best summarized as inclusive, adaptable, and interactive. By conducting evidence-based research and engaging in technology exchange and cooperation with local partners, the organization has developed a four-step approach that includes research and demonstration, policy recommendation, bilateral cooperation, and capacity building. This approach enables Institution G to establish strong and meaningful partnerships with stakeholders and to promote the dissemination of RETs.

4.2 Institution L

4.2.1 Overview

Institution L was founded in 2012 with the aim of advancing global analysis and research, promoting cross-sectoral dialogue and engagement among stakeholders, and supporting China's sustainable transformation through the development and implementation of climate and environmentally-friendly public policies. From a technological development perspective, the Institution primarily focuses on professional research, policy recommendations, and technical support related to technology diffusion and transfer. It provides a platform for technical cooperation and information exchange among stakeholders and strategically disseminates information to promote the trans-boundary export of renewable energy technologies.

One notable achievement is the collaboration of Institution L with 20 other Chinese and international NGOs, foundations, and think tanks to establish the Belt & Road Green Development Partnership, which harnesses expertise from diverse fields to generate innovative, high-quality, multi-perspective, and actionable research findings and policy recommendations. This platform provides guidance for the green planning and

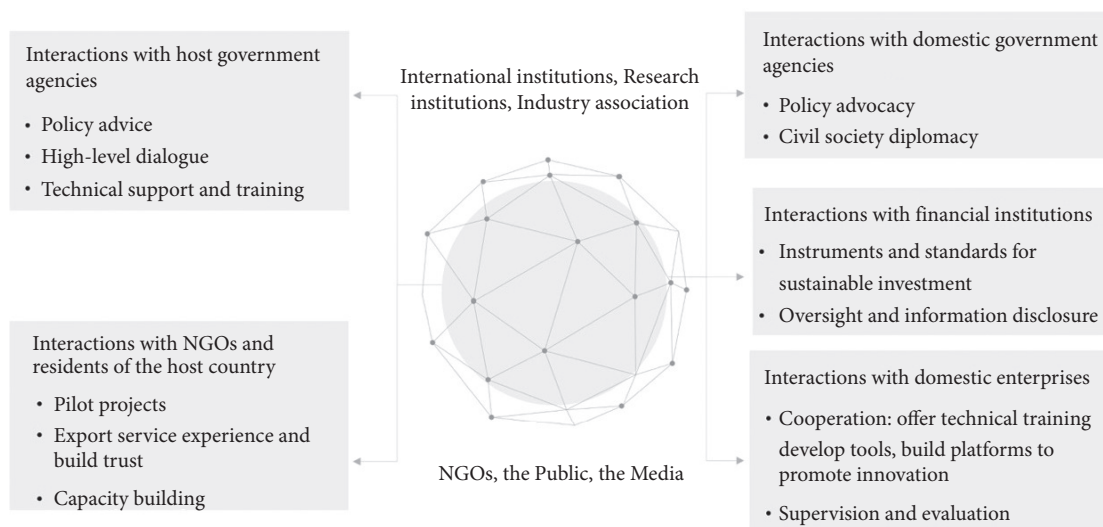


Fig. 2 Institution G's interactions with stakeholders.

construction of the Belt and Road Initiative, a crucial element of China's global development strategy. Furthermore, since 2017, the Institution has conducted research on Nationally Determined Contribution (NDC) power investment in four BRI countries. Through on-site investigations and expert discussions at different stages of the project, Institution L provided technical advice to stakeholders. As the coordinating organization of the Belt and Road Green Development Platform, Institution L actively promoted international exchanges and dialogues on climate governance and global green development by organizing seven side events at COP23 in collaboration with 17 partner organizations. (See Table A2 in the Appendix for details on this Institution's projects.)

4.2.2 Roles and functions

The focus of Institution L's work is on the technology diffusion and transfer phase, which is divided into two main aspects:

Advocate and information disseminator of RET transfer.

Since 2012, Institution L has been actively engaged in sharing insights and knowledge on climate change, energy, green finance, and investment through regular columns and publications. Institution L has emerged as a significant force in policy advocacy, employing effective information dissemination and cooperation strategies, and its policy recommendations have been adopted by the Chinese government. For instance, the 2016 report "Achieving a Mutually Beneficial South-South Cooperation on Climate Change-Learning from International Experience" released explores mutual benefits for aid recipient countries and suggests South-South cooperation mechanisms based on international best practices. By fostering international dialogues, publishing analyses, and disseminating findings, Institution L has amplified the voice of Chinese NGOs globally. For instance, in 2013, Institution L promptly responded to the EU's proposal to impose punitive tariffs on Chinese photovoltaic products and advocated for active dialogue between China and Europe. Consequently, Institution L has become a significant social force in promoting the global expansion of China's RET and conducting international diplomacy.

Mediator and advisor for various stakeholders. It has been engaging in industry observation, policy discussion and analysis, specialized research, and providing comprehensive perspectives. Institution L offers timely and insightful analyses of renewable energy-related policies, systematically building knowledge and capacity among stakeholders through over 20 professional reports and guides. The institution promotes multi-party dialogue and integrates diverse perspectives to steer the financial sector toward

environmentally responsible investments and complement government policies. Since 2012, Institution L has fostered a network of trans-boundary discussions and cooperation in green finance. It participates in consultations on environmental and social policies of developmental financial institutions, organizes symposiums, seminars, and green finance roundtables, and collaborates with other institutions to publish reports such as "Investment and Financing Models, Challenges and Recommendations of Renewable Energy Projects by Chinese Companies in the Belt and Road Countries (2021)" and "Environmental Risk Management Initiative for China's Overseas Investment (2018)". Additionally, Institution L collaborated with other research institutions and industry associations to co-author "Environmental Risk Management Manual for China's Overseas Investment". This manual provides Chinese enterprises with methods and tools to carry out risk management of overseas investment, thereby significantly promoting sustainable development practices and advancing renewable energy technologies globally.

Institution L faces several challenges in its development and operation. The scarcity of interdisciplinary talents with expertise in the transfer of RETs hinders its ability to provide comprehensive technical assistance and engage in early piloting. Moreover, establishing overseas offices is complicated by the need to obtain approval and navigate policy restrictions, limiting Institution L's potential to conduct technology assessment and matching on a global scale. Institution L also faces difficulties in raising funds and the limited sources of funding, which hinders the Institution L's efficiency in executing projects.

4.2.3 Interactions with stakeholders

Despite these challenges, as a think tank NGO, Institution L remains committed to leveraging expert knowledge to conduct industry research, provide policy advice, and facilitate dialogue among stakeholders (see Figure 3). While Institution L does not directly carry out technology transfer projects, it influences government agencies to issue relevant policies and shapes financial institutions' investment directions through specialized research and early-stage policy advocacy. As depicted in the graph, Institution L engages in strategic cooperation with the media, NGOs, and industry associations to communicate and disseminate policies through media interpretation and seminars. This enhances awareness and acceptance, indirectly contributing to the process of RET transfer.

However, Institution L primarily concentrates on policy advocacy and international exchange, with limited collaboration

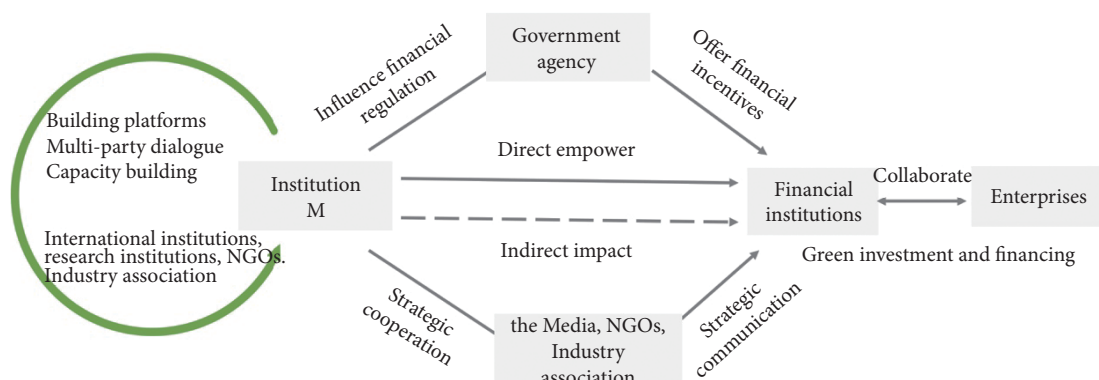


Fig. 3 Institution L's interactions with stakeholders.

with enterprises and few operational actions. Within the analytical framework's purview, Institution L is underutilized in terms of its potential to provide technical assistance, engage in early piloting, conduct technology assessment and matching, promote technology R&D innovation. Expanding its role in these areas could significantly boost its impact on RET transfer and sustainable development.

4.3 Institution M

4.3.1 Overview

Institution M was established in 1994 and registered with the Ministry of Civil Affairs. In 2020, it became independent from government agencies. Since its inception, the Institution M has been dedicated to promoting collaboration between Chinese and foreign civil society and supporting global sustainable development. It has played an active role in the formulation of China's laws on NGOs, policies related to foreign aid, and the internationalization of Chinese social organizations. As a bridge organization, Institution M has maintained strong relationships with international civil society organizations and multilateral institutions engaged in development and cooperation. It has actively supported Chinese NGOs in expanding their global reach, facilitated domestic and international NGO exchanges and collaboration, and coordinated the participation of Chinese social organizations in global governance.

In 2021, Institution M shifted its focus to ESG responsibility issues related to overseas investment, establishing a platform for communication and collaboration among social organizations, universities, think tanks, and enterprises at home and abroad. This strategic move aimed to break down barriers between domestic NGOs and enterprises. (See Table A3 in the Appendix for details on this institution's projects.)

4.3.2 Roles and interactions with stakeholders

Unlike the previous NGO cases, Institution M acts as a **bridge between Chinese NGOs and enterprises**, utilizing its extensive network to promote cooperation and exchange between civil society and market actors.

Information spreaders and demand-supply matchers. Institution M establishes technology cooperation and information exchange platforms to facilitate dialogues between social organizations and enterprises. For example, during the December 2022 seminar on "Promoting Chinese Enterprises to Effectively

Fulfill Corporate Social Responsibility Overseas," representatives from NGOs and technology enterprises discussed how social organizations can contribute to corporate social and environmental responsibility and promote mutual learning. Additionally, Institution M and NaaS Technology Inc., the first U.S. listed electric vehicle (EV) charging service company, released the "Civil-Business Integration for Sustainable Development Initiatives in the Middle East Region", further exemplifying their role in advocating for technology cooperation.

Counselors and advisors on capacity building. Institution M provides capacity-building training to assist enterprises in effectively fulfilling their social responsibilities overseas, implementing ESG principles, and improving their external communication and public relations strategies. This empowerment helps enterprises better integrate into local communities. Additionally, Institution M promotes overseas capacity-building projects, such as the "Sustainable International Cooperation: Increase Chinese NGO's Capacity on Going Out" project, to further enhance the capabilities of Chinese NGOs and enterprises.

Exchange and learning promoters. Institution M actively promotes exchanges among social organizations from China, Japan, and Republic of Korea, enabling them to learn from each other's experiences in collaborating with enterprises. By conducting visits to regions in Southeast Asia with Chinese-funded projects, Institution M gains valuable insights into their operations. Furthermore, projects like "Social Organizations and Enterprises Collaborate to Promote the Construction of Green Belt and Road" foster cooperation and knowledge-sharing between NGOs and enterprises. Institution M's involvement in the China Pavilion at COP28 in Dubai in 2023 highlights its role in facilitating the participation of Chinese social organizations in global climate governance. It has created a platform for Chinese NGOs to share China's emissions reduction experiences and engage in discussions with international participants on enhancing cooperation.

Institution M serves as an important bridge (see Figure 4), matching demands with supplies and promoting exchanges. It facilitates collaboration between Chinese NGOs and enterprises by sharing knowledge and experiences, while also securing funding and resources. Institution M empowers Chinese NGOs through capacity building, enabling them to advocate to host governments and deliver resources and capacity building to local communities, creating a dynamic and reciprocal relationship.

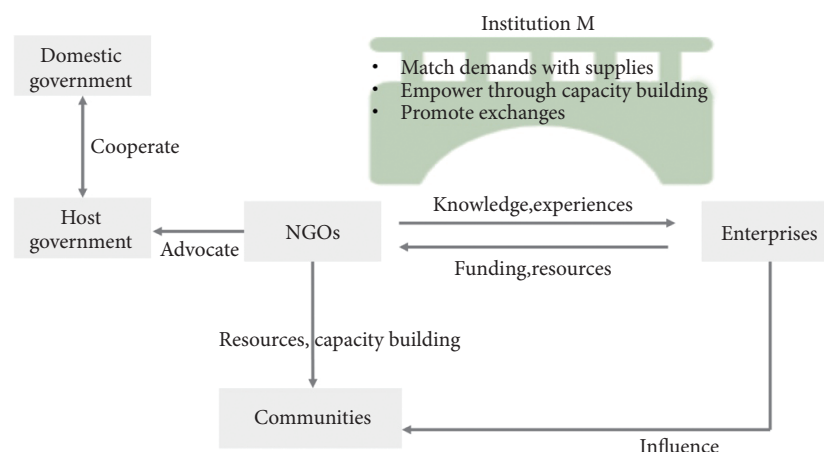


Fig. 4 Institution M's interactions with stakeholders.

4.3.3 NGO-enterprise cooperation issues

The case of Institution M illustrates the necessity and significance of NGO-enterprise cooperation in RET transfer. RET transfer faces numerous challenges, such as financial risks in investment and potential environmental impacts. Single-entity-led transfers often encounter disputes and opposition from local communities. Due to political constraints, the Chinese government struggles to address these issues directly, while enterprises face mistrust and opposition due to their commercial nature. In this regard, Chinese NGOs have valuable professional expertise, experience, and methods to coordinate relationships between host countries, local communities, and Chinese enterprises, and reduce the social and environmental risks brought about by technology transfer.

Furthermore, cooperation with NGOs offers enterprises significant benefits, including enhanced reputation and community relations, which help prevent conflicts and economic losses. NGOs, traditionally reliant on short-term projects and limited funding, can achieve sustainable operations overseas with corporate support. However, persistent misunderstandings between NGOs and enterprises often hinder collaboration, as corporations focus on profits and view NGO funding as a cost, while NGOs emphasize public welfare without clearly articulating mutual benefits. To bridge this gap, organizations like Institution M are essential in facilitating dialogue and cooperation, ultimately fostering social and economic benefits through effective RET transfer.

4.4 Brief summary

The ongoing wave of globalization and informatization, combined with the institutionalization of green and low-carbon transformation driven by environmental and climate crises, have facilitated the global technology transfer mode to evolve gradually into a grid-based mode involving multiple actors. As an emerging technology transfer actor, Chinese NGOs play diverse and critical roles in the trans-boundary transfer of RETs, including coordinating stakeholders, providing technical assistance and policy advice, building technology information exchange platforms, monitoring enterprises' overseas environmental and social responsibility, conducting pilot projects and providing professional advice to support enterprises' renewable energy investment and financing. As illustrated in Figure 5, the roles of NGOs in the cross-border transfer of renewable energy have been ordered according to their level of involvement, ranging from weaker to stronger, and from more advocacy-focused to more execution-oriented: 1) Technology advocates and information spreaders, establishing technology cooperation and information exchange platforms. 2) Technology transfer counselors and sponsors, who provide technical support, professional advice and relevant resources to enterprises. 3) Coordinators and mediators among stakeholders, who facilitate communication between stakeholders and mitigating potential conflicts. 4) Supervisors of technology implementation and evaluators of technology effects, providing factual evidence to support successful technology transfer. 5) Implementers and pioneers in conducting pilot projects, exploring innovative technology transfer solutions.

In fact, the number of Chinese NGOs involved in climate technology transfer is limited. The involvement of Chinese NGOs in trans-boundary transfer of RETs and their internationalization is at a relatively early stage and faces many challenges, including

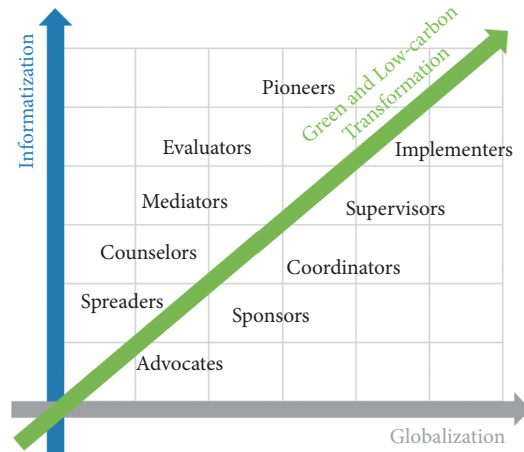


Fig. 5 Chinese NGOs' roles in trans-boundary climate technology transfer.

- 1) Limited global integration: Chinese NGOs are actively seeking to establish an international vision and values. However, their mechanisms and approaches towards participating in global environmental governance are still in the exploratory stage.
- 2) Inadequate policy and institutional support: Relevant policy support and guarantees are lacking for NGOs in areas such as material import and export, tax reduction and exemption, fundraising, and the establishment of overseas offices or branches, which must be in compliance with domestic laws and regulations. However, China has yet to establish laws and regulations for NGOs to participate in international affairs, nor has there been an effective communication mechanism or channel between NGOs and government agencies.
- 3) Lack of professional competence: Chinese NGOs lack professional competencies related to the whole process of technology transfer as well as a significant loss of highly skilled personnel.
- 4) Insufficient funding: Chinese NGOs' RET projects rely on a relatively narrow range of donors, lacking long-term and stable financial support. In particular, the support of the government's official foreign aid funds needs improvement.

5 Conclusions and outlooks

China plays an increasingly important role in advancing South-South and North-South climate technology transfer. In this study, we examine the dynamics of Chinese NGOs' engagement in trans-boundary climate technology transfer and shed light on the current challenges, and needs of NGOs. It is found that Chinese NGOs undertake various roles. They are advocates for RETs, coordinators among stakeholders, advisors for enterprises, pioneers in conducting pilot projects and so on. Despite their contributions, Chinese NGOs are still at a relatively early stage of RET transfer, encountering challenges in terms of funding, policy and competency.

Drawing on the findings of our study, it is recommended that Chinese government, civil society organizations, enterprises, financial institutions, and other stakeholders establish an open, transparent, and trusting communication and collaboration mechanism to support Chinese NGOs in expanding their global reach, establishing international influence, and collaboratively mitigating potential risks. These efforts are crucial for improving the sustainability of overseas renewable energy investments. We propose three strategic directions to foster Chinese NGOs' involvement in cross-border climate technology transfer:

First, enhanced exchange and collaboration. To improve the sustainability of overseas renewable energy initiatives, fostering exchanges and collaborative efforts between enterprises and social organizations during the technology transfer process is crucial. Involving Chinese NGOs in the planning, execution, and ESG assessments of these projects can help address potential social, political, and environmental risks. Given the multifaceted risks and challenges faced by countries and regions along the Belt and Road, NGO's involvement can help achieve synergistic benefits across multiple objectives and contribute to the inclusive growth of host countries.

Second, government support and legal frameworks. It is imperative that the government provides supportive policies and legal structures to ease Chinese NGOs' participation in foreign projects. This includes enacting specific regulations to assist NGOs in establishing international branches and engaging in government-funded technical projects. Incentive policies can also alleviate the difficulties that NGOs face in foreign exchange and taxation when they participate in technology export and overseas projects.

Third, diverse funding sources. we advocate for diverse funding channels to empower Chinese NGOs to effectively fulfill their roles. The transition of entities like the China Green Foundation and the National Green Development Fund from operational to grant-making bodies could extend financial support to a broader spectrum of Chinese NGOs. Moreover, we suggest that Chinese government could incentivize domestic foundations and enterprises to participate in global environmental governance and foreign aid through innovative mechanisms and policy incentives. By doing so, these mechanisms can guide the flow of financial

resources from the private sector to support NGOs' engagement in RET transfer.

This study contributes to the academic literature on the roles of NGOs in the trans-boundary transfer of climate technologies. The findings have generated practical implications for policy making, business strategies, and international NGOs community around RET transfer and management of overseas renewable energy projects. In this article, we offer insights to assist NGOs in China and other countries in effectively participating in global climate governance. We also highlight the potential for constructive communication and cooperation between social organizations and technology enterprises at global and regional levels. Such collaboration can help mitigate the risks associated with overseas investment in the renewable energy sector.

It is important to acknowledge that our study is limited by its focus on a relatively short time period and lack of perspectives from host countries, which would provide a more comprehensive understanding of the effects of NGOs' involvement. As such, future research should explore the long-term evolution of NGOs' involvement in climate technology transfer, drawing on longitudinal data and experiences from various stakeholders to inform this important area of inquiry. As research continues to accumulate on Chinese NGOs' evolving roles in trans-boundary technology transfer, scholars can conduct comparative analysis between Chinese and Western NGOs to deepen understandings and generate findings with greater theoretical depth and broader implications.

Appendix

Table A1 Projects on trans-boundary transfer of renewable energy technologies by Institution G.

Year	Projects	NGO's Roles
2009	Introduced biogas systems in Sri Lanka. The project involved technical training and the construction of biogas digesters.	Technical assistance
2009	Participated in UNFCCC COP15 and held a side event on "Accelerating Technology Diffusion - Chinese NGOs' Practice". During the conference in Copenhagen, Denmark, Institution G emphasized the urgent need to accelerate technology diffusion to address climate change.	Participating in international advocacy
2012	A closed-door meeting was held in Yangon, Myanmar to exchange views on the Myitsone Hydropower Project. Chinese government officials, Myanmar government officials, representatives from academia and NGOs were invited to have a frank and in-depth exchange on the Myitsone incident.	Coordinating stakeholders
2013	Organized "Rural Renewable Energy Technology and Financing" workshop in Yangon, Myanmar. Promoted the cooperation between China and Myanmar on rural renewable energy and infrastructure services.	Technology advocacy; Promoting technical cooperation
2015	Promoted the signing of a supplemental agreement to the Memorandum of Understanding on South-South cooperation in addressing climate change between China and Myanmar. Implemented the "Myanmar Forest Conservation based on Clean Energy Technology Application" project in Myanmar to promote cooperation between China and Myanmar in addressing climate change.	Technical assistance
2015	Organized 2 training sessions on corporate social responsibility and environmental protection capacity building. Advocating for policies to guide and regulate enterprises' foreign investment behavior and help them better handle the environmental and social risks overseas.	Policy advocacy; Providing capacity-building training
2016	Guided African journalists to re-examine China's investment and trade with Africa - organizing media training workshops. China-Africa Governance Project was held, under which a series of activities were carried out, such as journalist exchanges, research studies, high-level dialogues, etc.	Promoting dialogue
2018	The seminar on "Promoting Renewable Energy Development in Myanmar" was co-organized with the Department of Research and Innovation of the Ministry of Education of Myanmar. The low-carbon and renewable energy development planning tool and its application cases in China and Sri Lanka were introduced, and a cooperation agreement was signed with Myanmar to further carry out technical research and cooperation in renewable energy.	Promoting the use of planning tools
2018	Organized technical training on renewable energy planning and implementation tools in Myanmar in cooperation with various organizations. Provided advanced technical training on project implementation for the Myanmar Renewable Energy Working Group, arranged field visits to local solar and diesel hybrid microgrid project sites in Myanmar, and developed a plan for next steps.	Providing technical support

(Continued)

Year	Projects	NGO's Roles
2019	Held a seminar on "Renewable Energy Implementation Methodology and Tool Development and Application" with Guangzhou Institute of Energy Research, Chinese Academy of Sciences. Between 2017 and 2019, the promotion and piloting of renewable energy planning tools in Guangdong and Shanxi, as well as commercial financial analyses of PV solar projects, were completed. Additionally, a national solar resource assessment was conducted for Myanmar.	Conducting pilot projects
2019	A conference was hosted on "China-ASEAN Cooperation to Promote Energy Transition and Climate Resilient Development" to facilitate the exchange of views on the challenges and potential opportunities for ASEAN countries to implement NDC.	Establishing a platform for exchanging information
2021	Institution G, in collaboration with GreenID (a Vietnamese NGO) and Beijing University of Architecture, provided data support for rooftop PV projects in Vietnam. Through the use of AI technology, all available rooftop resources in the provinces of Bac Lieu, Dong Thap, and Quang Tri were identified, providing data support for the subsequent development of rooftop PV projects for public buildings by the Vietnamese government.	Providing technical support
2021	Matchmaking with Myanmar renewable energy investment and financing stakeholders. Meetings were held with Chinese financial institutions, investors, and PV companies, such as the Ford Impact investment team and LONGi technology assistance project leaders. These exchanges facilitated discussions on the possibility of investment in distributed PV projects in Southeast Asia.	Coordinating stakeholders
2021	Provided professional consulting services for photovoltaic power generation projects in Myanmar. Specifically, completed investment feasibility analysis and financing model design for three projects: the Mandalay City Industrial Park Rooftop PV Power Project, Mandalay Region Small Village Off-grid PV Power Project, and the proposed Mergui Sea Shrimp project, which involved replacing diesel power generation with PV.	Providing professional advice
2021	Conducted a special study to assess Indonesia's national PV resource potential. Institution G collaborated with Indonesian partner organization IESR (Institute for Essential Services Reform) to analyze Indonesia's national PV resource potential and produced a report titled <i>"Beyond 207 GW: Unleashing Indonesia's Solar Potential"</i> . It significantly increased Indonesia's confidence in developing its PV resources.	Conducting specialized studies; Providing policy advice
2022	The "China-ASEAN Cooperation in Promoting Renewable Energy Development and Implementing Climate Commitments" Seminar was held. Climate experts, government officials, representatives of financial institutions and energy companies from Indonesia, Vietnam and China attended the seminar to discuss issues such as renewable energy trends, policy drivers, investment prospects and business operation modes in the China-ASEAN region.	Technology advocacy; Promoting exchange and cooperation
2022	Organized and participated in side events at UNFCCC COP27, bringing the voices of China's non-state actors to the global stage. Activities included: High-level forum on south-south cooperation in addressing climate change; Energy accessibility and community-led climate adaptation: case studies from China, Southeast Asia, and Africa; Promoting sustainable investment and trade in the Congo Basin to protect forest ecosystems.	International advocacy; Promoting cooperation
2023	Conducted field study in rural communities of Cameroon to explore and address the electricity issues in communities surrounding forests. The goal was to enhance the living standards and well-being of local villagers through the development of renewable energy, and to further motivate community participation in forest conservation. GEI conducted a survey on electricity usage and needs in rural communities, covering four unelectrified areas in the provinces of East and Centre.	Needs assessment; Community engagement

Table A2 Projects on trans-boundary transfer of renewable energy technologies by Institution L.

Year	Projects	NGO's Roles
2012	Hosted roundtable discussions on green finance. Institution L is the primary initiator and coordinator of the China Climate Policy Group. They organized the Green Finance Roundtable and regularly invited experts from various fields to share and discuss climate and energy issues. This enhanced the professional capacity of social organizations in the climate field and created a sustainable learning mechanism.	Promoting the exchange of ideas and dialogue
2013	Called for active dialogue between China and Europe on trade policy. Institution L responded promptly to the EU's "anti-dumping" investigation and its impact by focusing on the potential consequences. They opposed the EU's proposal to impose punitive tariffs on Chinese PV products and called for constructive dialogue between China and Europe.	Facilitating policy-oriented discussions and active dialogue
2014	Collaborated with Center for Financial Research of the central bank of China to analyze the financing issues in energy transition. The project "Coal Consumption Control - Financial Perspective" was launched officially in collaboration with the People's Bank of China and the China Banking Regulatory Commission.	Conducting specialized studies; Policy advocacy
2015	Organized information exchange and cross-border dialogues in the field of climate and energy. Coordinated the work of the China Climate Policy Group (CPG) to organize six cross-border dialogues, publish 78 climate newsletters in English and Chinese, and highlighted significant climate and energy events both domestically and internationally.	Establishing a renewable energy information platform
2016	Launched Green Belt and Road-related publications to facilitate exchanges among various parties. Participated in the launch meeting of Belt & Road Green Development Partnership and launched the bimonthly magazine "Green Focus - China and the World", which provided in-depth interpretation of the issues related to the green development of the Belt and Road.	Promoting technical exchange and discussion
2017	Participated in policy consultations regarding environmental and social issues for development financial institutions. The formulation and implementation of sustainable investment policies at the Asian Infrastructure Investment Bank (AIIB) and the BRICS New Development Bank (NDB) were followed. Valuable opinions and suggestions were provided on the draft Energy Investment Strategy of AIIB and the Environmental and Social Framework of NDB. Some of these suggestions were adopted by the banks.	Promoting technology diffusion; Providing investment advice

(Continued)

Year	Projects	NGO's Roles
2017	Organized side events at COP23 for Belt & Road Green Development Partnership. As the coordinator of Belt & Road Green Development Partnership, Institution L organized seven side events at COP23 to facilitate international exchange and dialogue with partner institutions. Additionally, a workshop was held to discuss the establishment of a compliance monitoring mechanism for overseas environmental and social risk management.	Coordinating stakeholders; Promoting international exchanges
2018	Jointly completed the research report "Comparative Analysis of Coal-Fired Power Financing Policies of International Financial Institutions, Multilateral Initiatives and Chinese Financial Institutions" to provide suggestions and references for Chinese financial institutions to formulate their sustainable investment strategies in the context of climate change.	Conducting specialized studies; Policy advocacy
2019	Co-authored "Environmental Risk Management Manual for China's Overseas Investment" to provide Chinese investors with systematic and actionable applicable methods and tools for risk management of overseas investment.	Providing tools, methods and technical support for enterprises
2019	Released the research report "Opportunities and Challenges of Belt and Road Overseas Investment in the Power Sector under the Paris Agreement" , examining the impact of NDC targets on the power sectors of Vietnam, Indonesia, and Pakistan. It identified a baseline for power investment that aligns with carbon-neutrality and provided recommendations and suggestions for Chinese policymakers and investors to develop low-carbon power investment plans for the BRI that align with the long-term temperature control objectives of the Paris Agreement.	Conducting specialized studies; Policy advocacy
2020	Co-writing "Investment and Financing Models, Challenges and Recommendations of Renewable Energy Projects by Chinese Companies in BRI countries" , examining the potential for renewable energy projects in BRI countries and the current involvement of Chinese enterprises. It analyzed and compared PV and wind power projects across 25 BRI countries, including different types of investment entities and financing models.	Conducting specialized studies; Providing policy advice
2020	Released the research report "Opportunities and Challenges of China's Renewable Energy Overseas Investment Case Study - Vietnam" . This study compared Vietnam's energy planning, climate action, environmental legal system, and governance goals with China's under the Belt and Road Initiative. It analyzed the current situation and trends of renewable energy development in Vietnam, identifies barriers, risks, and opportunities for Chinese renewable energy investment in Vietnam, and provided recommendations for Chinese investors.	Conducting specialized studies; Providing investment advice
2022	"COP15 Outlook - Biodiversity Financing Risks in China's Overseas Investments: Guidelines for Chinese Financial Institutions and Companies Promoting a 'no-entry' Policy" Workshop, co-organized with WWF. The objective was to highlight the positive contribution of financial institutions to promote China's commitment to biodiversity conservation during the second phase of COP15.	Technology and investment advocacy; Facilitating exchanges and discussions
2023	Co-organized the "Special Edition for the Third Belt and Road Forum for International Cooperation" with a focus on supporting the green, high-quality development of the Belt and Road Initiative. The event featured a live dialogue on climate risks and renewable energy solutions for BRI countries. Key topics included the climate risks and vulnerabilities faced by BRI countries, the role of financing in supporting sustainable development, and renewable energy solutions to address climate challenges.	Facilitating exchanges and discussions; Enhancing dissemination

Table A3 Projects on trans-boundary transfer of renewable energy technologies by Institution M.

Year	Projects	NGO's Roles
2015	Joint held the 6th East Asia Civil Society Forum. The forum focused on the theme of "Corporate Social Responsibility and Volunteerism", and brought together nearly 100 experts, scholars, and representatives from civil society organizations in China, Japan, and Republic of Korea. Attendees shared their experiences and engaged in academic exchanges and seminars related to corporate social responsibility and volunteerism.	Promoting international exchanges and cooperation
2016	Launched a comprehensive training program for social organizations going out. This project aimed to enhance the capacity of social organizations to participate in international affairs, and to establish a foundation for Chinese social organizations to engage in overseas project operations.	Providing capacity-building training
2017	Completed the project of "Capacity Building for Chinese NGOs Going out to Participate in International Development Cooperation". The China International Center for Economic and Technical Exchanges (CICETE) supported the project. This project aimed to conduct a systematic and scientific inventory and capacity assessment of Chinese NGOs going abroad. The project carried out targeted training activities based on the research results to effectively address existing obstacles for NGOs going abroad.	Conducting specialized studies; Provide tool guidance
2018	Held the first Lancang-Mekong Civil Society Forum. The event brought together more than 100 people from relevant government departments, NGOs, enterprises, experts, scholars, and media representatives from 6 countries in the Mekong region. The participants offered advice and suggestions to enhance international cooperation among NGOs in the Mekong region.	Establishing a non-governmental exchange platform
2020	Launched the Chinese podcast "Interpretation of Energy and Climate Change Reports by Overseas Think Tanks" and the English audio program "REEI Energy and Climate Podcast". The podcasts provided 22 audio interpretations covering topics such as energy outlook, green recovery, carbon neutrality, green politics, and carbon emission reduction.	Information dissemination; Policy advocacy
2021	Published content related to energy transition. Institution M published a total of 88 issues of the audio program "Energy Review" and "Interpretation of Energy and Climate Change Reports by Overseas Think Tanks", with a cumulative broadcast of about 42,000 times. Additionally, Institution M wrote and published 18 research articles and 6 newsletters related to energy transition and carbon pricing.	Promoting technical exchanges and policy interpretation; Improving public awareness

(Continued)

Year	Projects	NGO's Roles
2021	Conducted the research project "Chinese Enterprises' Effective Fulfillment of Social Responsibility in Overseas Investment", involving 77 Chinese enterprises and 29 Chinese and foreign NGOs. The first draft of the research report was completed in 2021, sharing results on Chinese enterprises' overseas social responsibility fulfillment, experiences of Japan's and Republic of Korea's enterprises, social organization participation, and suggestions for strengthening NGO-enterprise cooperation.	Conducting specialized studies; Supporting Chinese enterprises' foreign investments to fulfill their ESG responsibilities
2022	A forum was held on "Chinese Enterprises' Overseas Social Responsibility Cooperation", where a research report on "Promoting Chinese Enterprises' Overseas Investment to Effectively Fulfill their Social Responsibilities" was released. Representatives from various sectors participated in the forum to discuss new ideas on promoting enterprises' overseas responsibilities through NGO-enterprise cooperation. The report provided references for NGO-enterprise cooperation from the perspectives of CSR and ESG concepts, China's concept of social responsibility, Japan's and Republic of Korea's experiences, and domestic social organization practices.	Conducting specialized studies; Providing policy advice
2022	Organized the forum on "Cooperation between Social Organizations and Enterprises under Global Climate Change and Carbon-neutrality Goals". Representatives from various sectors, including government departments, academic institutions, enterprises, industry associations, domestic and international social organizations, and the media, participated in an in-depth discussion on the cooperation between social organizations and enterprises to help achieve the carbon-neutrality target.	Enhancing information sharing
2022	Hosted a forum on "Promoting Green Ideas and Innovation for Green Silk Road Construction – NGO-Enterprise Cooperation to Promote Environmental Responsibility of Chinese Enterprises in Africa". The forum focused on exploring the opportunities and challenges of Chinese enterprises' overseas investments, promoting effective communication with local communities through the professional capacity of social organizations, and supporting enterprises in fulfilling their overseas social responsibilities.	Facilitating productive exchange and collaborative dialogue
2022	Hosted the "China-ASEAN Civil Forum for Development", with the theme of investing in ASEAN social responsibility. During the forum, representatives from enterprises such as Power Construction Corporation of China and LONGi, and Chinese social organizations discussed the needs and prospects of overseas NGO-enterprise cooperation in areas such as ecological protection, poverty reduction and development, and community development.	Strengthening communication among stakeholders
2022	Organized a series of seminars and training activities for Chinese enterprises to fulfill their ESG responsibilities overseas. Seminars such as "Promoting Chinese Enterprises to Effectively Fulfill Corporate Social Responsibility Overseas" were held by the organization. Additionally, a training session titled "Cooperation between Social Enterprises and Chinese Enterprises in Fulfilling Green Social Responsibility Overseas" was conducted to share the value and roles of social organizations in promoting companies' environmental and social responsibility.	Promoting exchanges and cooperation between social organizations and enterprises
2023	Hosted the "Capacity Building Workshop on NGO's Participation in the International Advocacy Platform", attended by around 80 people from universities, domestic and international NGOs, and the media. The workshop discussed theories and experiences of Chinese NGOs' efforts to "go out" from the perspective of global governance, and reviewed experiences of international organizations' participation in the C20 and BRICS Civil Society Organizations Forum. The "Handbook on the Participation in the Emerging Advocacy Platforms" was released to provide reference for domestic NGOs to be active on international emerging advocacy platforms.	Providing capacity-building training; Establishing exchange platform
2023	Organized side events, press releases, and an exhibition in collaboration with partners at the China Pavilion at COP28 in Dubai. Institution M hosted the event "Stakeholders' Practice and Prospect for Meeting Climate Targets", where Chinese NGOs shared China's emissions reduction experience and international participants discussed ways to enhance cooperation. Institution M and NaaS Technology Inc. the first U.S. listed EV charging service company released the "Civil-Business Integration for Sustainable Development Initiatives in the Middle East Region".	Promoting technical exchanges and policy interpretation; Facilitating business cooperation

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Declaration of competing interest

The authors have no competing interests to declare that are relevant to the content of this article.

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