Postprint: A Study on the Development of International Science and Technology Organizations in China

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Abstract

International science and technology organizations aggregate and integrate substantial global innovation resources, serving as advocates for science and technology policies and norms, formulators of international technical standards and rules, and coordinators of advanced concepts. Under current global circumstances, the development level of international science and technology organizations has become a critical manifestation of a nation's scientific and technological civilization and comprehensive strength. Nevertheless, our country presently confronts numerous challenges, including a limited number of international science and technology organizations and the absence of mature mechanisms for their introduction, management, and service provision. This article examines the subject from the perspective of international science and technology organizations, summarizing their significant functions, reviewing relevant policies from foreign entities and various domestic departments and localities in recent years that support the development of such organizations, and conducting an in-depth analysis of deficiencies in our nation's efforts to initiate and establish international science and technology organizations, attract them to establish a presence, and participate in their affairs, in conjunction with the current development status of these organizations within our country, while proposing corresponding countermeasures and recommendations.

Full Text

Research on the Development of International Scientific and Technological Organizations in China

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Abstract

International scientific and technological organizations (ISTOs) serve as critical platforms that aggregate and integrate global innovation resources. They function as advocates for science and technology policies and norms, formulators of international technical standards and rules, and coordinators of advanced concepts. In today's global landscape, the development level of ISTOs has become an important indicator of a nation's scientific and technological civilization and comprehensive strength. However, China currently faces numerous challenges, including a limited number of ISTOs and the absence of mature mechanisms for their introduction, management, and service provision. This paper examines ISTOs from an international perspective, outlines their vital roles, reviews relevant policies from foreign countries and various domestic departments and localities that support ISTO development in recent years, and analyzes the current status of ISTOs in China. The study delves into existing deficiencies in initiating and establishing ISTOs, attracting them to settle in China, and participating in their affairs, and proposes corresponding policy recommendations.

Keywords: international scientific and technological organizations, initiation and establishment, settlement, representation in international organizations

1. Current Status and Analysis of ISTO Development Research in China

With the development of global economic integration, the number of international scientific and technological organizations has grown substantially. The quantity and quality of ISTOs initiated or introduced by a country not only reflect its comprehensive strength and scientific influence but also contribute to shaping a favorable international image. In recent years, scholars have increasingly focused on the development of ISTOs in China, conducting extensive research on initiating and establishing ISTOs, attracting them to settle in China, and cultivating talent for international organizations.

Regarding the initiation and establishment of ISTOs, Wang Yan and Luo Xueyou et al. have examined the geographic distribution of ISTO headquarters and identified challenges in cultivating ISTOs in China. They propose that government departments should increase support for ISTO clusters, pilot initiatives in highly internationalized regions, and create new opportunities and conditions for ISTO development. In terms of attracting ISTOs to China, Qi Jing analyzes the resource agglomeration effects of hosting ISTOs

and provides guidance on formulating settlement policies and optimizing management systems. Xia Ting et al. explore the challenges Chinese scientific organizations face when joining international S&T organizations, noting that Chinese societies generally lack international visibility and influence, and offer recommendations from the perspectives of increasing participation in core international S&T organizations and enhancing organizational activity.

Concurrently, scholars have actively contributed suggestions on participating in ISTO activities and cultivating talent. Li Junping et al. identify major obstacles for Chinese experts entering ISTOs and recommend strengthening training in diversified international knowledge and skills to enhance their competency for leadership positions. Gong Haihua et al. analyze cooperation between the Chinese Academy of Sciences and relevant international S&T organizations from the perspectives of international influence, team strength, and project volume. They find that China's understanding of international S&T organizations remains unsystematic and superficial, making it difficult to secure international discourse power commensurate with China's global standing, and propose that universities and research institutes should leverage their team advantages to strengthen the construction of a talent pipeline for international S&T organizations. Zhu Yalan et al., using the International Thermonuclear Experimental Reactor (ITER) as a case study, analyze effective pathways to enhance China's science diplomacy and recommend that government departments such as the Ministry of Science and Technology, Ministry of Education, and Ministry of Foreign Affairs vigorously cultivate talent for international S&T organizations.

Overall, current academic research on ISTO development in China primarily focuses on encouraging Chinese S&T organizations to initiate or establish ISTOs, attracting ISTOs to settle in China, actively participating in ISTO affairs, and cultivating talent. However, systematic research on the current development status, problems, and obstacles remains lacking. This paper systematically reviews China's policies regarding participation in or initiation of ISTOs, investigates and summarizes the current development status and challenges of ISTOs in China, and provides research support for initiating and attracting more ISTOs.

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2. Domestic and International Policy Research on ISTO Introduction and Cultivation

International organizations are transnational entities composed of national institutions, while international scientific and technological organizations serve as direct carriers for international organizations' activities in the S&T domain. Their research scope encompasses multiple dimensions and fields, presenting certain difficulties and complexities. This study categorizes international organizations as shown in [Figure 1: see original paper]. By attribute, international organizations can be divided into intergovernmental and non-governmental organizations. Non-governmental organizations can be further

classified by location as domestic non-governmental organizations and overseas non-governmental organizations—those legally established within China and those legally established outside China. By nature, international organizations can be divided into political (comprehensive) organizations and professional organizations. Political organizations cover politics, economy, society, culture, and other fields, while professional organizations focus on specialized technical fields such as science and technology, education, health, environment, and sports. Among these, organizations with S&T as their primary field are called international scientific and technological organizations, while other professional organizations may also possess S&T attributes and connotations, such as environmental protection and sustainable development organizations and the International Bamboo and Rattan Organization.

2.1. China's Policies on Establishing and Attracting ISTOs

China's top-level policy documents, including S&T development plans and social development plans, all mention the significance and importance of ISTOs. The *National Medium- and Long-Term Plan for Science and Technology Development (2006–2020)*, the *14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives Through 2035*, and the *CAST Development Plan for the 14th Five-Year Plan Period (2021–2025)* all explicitly state support for initiating and establishing ISTOs within China. Various departments have also recognized the importance of encouraging ISTOs to develop in China and have successively issued relevant policy documents involving incentive measures for initiating ISTOs, supporting their settlement, and encouraging participation in their activities, aiming to create a more convenient environment for their operation in China.

(1) Attracting ISTOs to settle in China. The *13th Five-Year Plan for National Science, Technology and Innovation* mentions leveraging the role of civil organizations in promoting international S&T innovation cooperation and striving to attract international organizations to settle in China. The *CAST Organizational Development Plan for the 14th Five-Year Plan Period (2021–2025)* proposes guiding ISTOs to register and establish headquarters in China, and actively encouraging ISTOs or their branches to set up secretariats in China. These policies demonstrate the distinctive characteristics of ISTOs as non-governmental, professional organizations primarily engaged in science and technology, highlighting their key role in building scientific communities and global S&T governance systems. They also reflect China's philosophy and confidence in actively integrating into global innovation networks.

(2) Actively joining various ISTOs. Eight departments, including the China Association for Science and Technology, Ministry of Education, and Ministry of Science and Technology, jointly issued an initiative supporting more young S&T talent in China to actively join ISTOs and play their roles. The State Administration for Market Regulation also advocates for enterprises and research institutions to actively participate in activities of various international

standardization organizations. Regarding encouraging Chinese S&T organizations and researchers to participate in ISTO affairs, the Ministry of Science and Technology and CAST propose supporting Chinese S&T organizations to actively engage in ISTO activities and encouraging experts to hold positions in important ISTOs and participate in international standard development. Additionally, local *14th Five-Year Plans for Science, Technology and Innovation* also propose encouraging Chinese S&T organizations to actively participate in ISTO work, laying a policy foundation for supporting China's move to the center stage of international S&T exchange and cooperation.

(3) Promoting ISTO exchanges and strengthening talent cultivation. CAST proposes strengthening exchanges and cooperation with science and technology communities in Hong Kong, Macao, Taiwan, and innovative countries. The Ministry of Civil Affairs, together with relevant departments, has formulated policies for foreign S&T talent to join Chinese S&T organizations, which both support Chinese S&T organizations in better playing their role in talent introduction and enhance communication with foreign S&T talent, guiding them to join Chinese S&T organizations and make new contributions to S&T development in China and the world. In strengthening ISTO talent cultivation, the *Opinions on Strengthening the Cultivation and Recommendation of Talent for International S&T Organizations*, jointly issued by CAST and the Ministry of Civil Affairs, emphasizes building a sustainable talent cultivation and recommendation system.

Local governments have also prioritized accelerating the introduction of ISTOs as an important indicator of internationalization. Beijing has proposed policies to attract ISTOs that align with its functional positioning to settle in the city. Shanghai encourages and supports important ISTOs to establish headquarters or branches in Shanghai. Shandong, Henan, Chongqing, Hainan, and other regions have released relevant policies to actively attract ISTOs to set up offices in their localities, promoting steady and efficient development of local ISTO construction. Local management departments also leverage policy guidance by establishing various settlement incentive mechanisms. For example, Shanghai, Guangdong, and Nanjing have introduced policies providing financial rewards and subsidies of varying amounts to ISTO headquarters (or branches) that successfully settle locally. An analysis of relevant policy measures for ISTOs in China is detailed in .

Overall, initiating and establishing ISTOs and attracting them to settle in China align with China's overall S&T development goals and strategic deployment. This is particularly important for seizing opportunities in the new round of S&T revolution and continuously contributing to global scientific progress and sustainable development. China is implementing various measures to promote ISTO development in China, continuously gathering international advantageous S&T resources and innovation elements, and expanding the depth and breadth of participation in global governance.

2.2. Policy Measures of Developed European and American Countries in Establishing and Attracting ISTOs

Developed European and American countries hold obvious advantages in attracting ISTOs to settle locally, benefiting from their sound urban infrastructure, international urban environment, and policy guidance and specialized services at both national and city levels. The current development landscape of ISTOs presents a "Western-centered" reality, fully demonstrating the high importance these countries attach to initiating and establishing ISTOs, attracting them to settle, and encouraging S&T workers and organizations to participate in ISTO affairs.

(1) Providing institutional guarantees for ISTO development. Belgium's *Host Nation Policy* comprehensively regulates procedures related to the operation and management of international organizations and emphasizes compliance with international treaties when dealing with intergovernmental and supranational organizations in Belgium. France's *Law on Non-Profit Associations* regulates systems and procedures for various associations in France, creating conditions for the healthy development of S&T organizations. The U.S. *Charitable Donation Law* and *Internal Revenue Code* clarify the rights and interests of public welfare ISTOs in fund usage and tax preferences. Japan's *Tokyo Metropolitan International Policy Promotion Outline* identifies attracting ISTOs as an important measure for urban internationalization. Additionally, Belgium and Germany have established specialized management agencies for international organizations to actively engage with organizations interested in settling in cities like Brussels and Bonn and provide them with services.

(2) Providing tax incentives and financial support for ISTO settlement. The U.S. *Internal Revenue Code* explicitly stipulates that international non-governmental organizations operating on a non-profit principle in the U.S. are exempt from state and local property taxes, income taxes, and sales taxes. Their non-profit income, including social donations and government appropriations, enjoys the same tax-exempt benefits, indirectly increasing revenue sources for relevant international organizations. New York also includes most public service projects undertaken by S&T organizations in the government procurement service list to compensate for their public welfare expenditures. Japan has established an "NGO Project Subsidy System" and a "Japan NGO Support Grant Mechanism" to provide financial support for NGO development. Furthermore, cities like New York, Tokyo, and Seoul actively attract ISTOs by offering venue rental and operational subsidies. Singapore and Thailand have also created livable and business-friendly environments for introducing ISTOs.

(3) Actively participating in ISTO affairs and emphasizing the cultivation of reserve talent. Germany excels at leveraging the influence of ISTOs to host large-scale international academic conferences to enhance its cities' international image and drive the agglomeration of international S&T innovation resources. Japan encourages Tokyo to actively participate in important activ-

ities organized by ISTOs to raise the city's international influence. The UK offers specialized international organization courses for students, holds international organization seminars, and provides employment consulting services for international organizations, helping students understand the functions and employment standards of various international organizations while cultivating their interdisciplinary knowledge literacy, cross-cultural communication skills in academic exchanges, and adaptability in handling international organization affairs, laying a solid foundation for them to better hold positions and perform duties in international organizations. Detailed policies and measures from various countries for attracting and cultivating ISTOs are shown in .

Learning from the experiences of developed European and American countries in attracting ISTOs provides comprehensive and complete demonstration effects for China to introduce ISTOs with a more open mind, more inclusive vision, and more precise approaches, and to give full play to the hub role of ISTOs in the global innovation network, offering new ideas for expanding international S&T cooperation and deepening international S&T and cultural exchanges under the current complex and volatile international situation.

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3. Current Status of China's Participation in ISTO Activities

3.1. Chinese S&T Organizations' Participation in ISTOs at Various Levels

Since the 18th National Congress of the Communist Party of China, Chinese S&T organizations have actively joined various international S&T organizations. At the government level, Chinese S&T organizations have participated in over 200 international organizations and multilateral mechanisms covering S&T fields. Particularly since the implementation of the "Belt and Road" S&T Innovation Action Plan in 2017, as of January 2023, Chinese S&T organizations have signed more than 200 cooperation documents on jointly building the "Belt and Road" with 151 countries and 32 international organizations, effectively promoting innovation cooperation with "Belt and Road" partner countries in S&T and cultural exchanges, joint laboratory construction, science park cooperation, and technology transfer.

At the civil society level, the *CAST 2022 Annual Statistical Bulletin on Organizational Development* shows that as of 2022, Chinese science and technology associations at various levels (including CAST itself) and their two-tier societies had joined 875 international S&T organizations, a decrease of 28 from 2021, representing a 3.1% year-on-year decline ([Figure 2: see original paper]). According to incomplete statistics, as of June 2023, China had over 40,000 S&T organizations, among which 17 international S&T organizations have been legally registered with the Ministry of Civil Affairs of the People's Republic of China.

3.2. Chinese Experts and Scholars Holding Positions in ISTOs

Various departments in China are actively recommending experts and scholars for leadership positions in ISTOs and cultivating talent for these organizations. According to CAST statistics, as of 2021, Chinese experts and scholars held 2,446 positions in international S&T organizations, a 23.3% increase from 1,984 positions in 2019. Among them, 1,265 held senior-level positions, accounting for 51.7% of total senior positions, representing a 51.5% increase from 835 senior-level positions in 2019 ([Figure 3: see original paper]). According to Chinese Academy of Sciences statistics, as of 2020, CAS researchers held 981 positions in international organizations, a 50% increase from 655 positions in 2012, with 331 holding key positions such as chair, vice-chair, or national representative, a 109% increase from 2012.

China has also participated in numerous activities initiated by ISTOs. As early as 1984, the Chinese Academy of Sciences joined the International Council for Science's Committee on Data (CODATA) and established its Chinese National Committee, promoting international exchange of scientific and technological data by organizing data construction and sharing services across various departments. In 2001, China officially joined the International Argo Program and deployed China's Argo ocean observation network, providing Chinese experts with valuable opportunities for synchronous access to real-time Argo data. In 2021, two international research centers established by the China Geological Survey successfully joined the Group on Earth Observations (GEO) and initiated long-term data exchange, contributing Chinese strength to global scientific data governance and utilization. By the end of 2022, over 200 international organizations from more than 150 countries and regions had participated in the "Belt and Road" international S&T organization cooperation platform initiated by China, which has cultivated 36 regional S&T organizations or alliances and 36 research or training centers, and trained over 119,000 S&T talents.

3.3. China's Financial Investment in International Organization Activities

In recent years, China has conducted multi-form, multi-level international S&T activities with major countries and regions. In terms of expenditure, according to national general public budget final accounts statistics, China's expenditure on international organization affairs reached 16.924 billion yuan in 2022, a year-on-year decrease of 6.3%. Over the past decade, China's expenditure on international organization affairs has shown a fluctuating growth trend overall. In terms of departmental expenditures, 46 departments including the Ministry of Foreign Affairs and Ministry of Science and Technology spent 17.803 billion yuan on international organizations, a year-on-year increase of 10%. Specifically, the Ministry of Science and Technology spent 26.8842 million yuan (up 4.5% year-on-year), CAST spent 10.9189 million yuan (up 22.2% year-on-year), and the Chinese Academy of Engineering spent 39,500 yuan (down 1.5% year-on-year). The total expenditure on international organization affairs by various

departments and their proportion of the departments' annual final accounts are shown in [Figure 4: see original paper].

3.4. Cultivation of Reserve Talent for International S&T Organizations

In cultivating personnel capable of operating in international organizations, the Ministry of Science and Technology dispatches researchers from different fields to core departments of the International Thermonuclear Experimental Reactor (ITER) organization. As of 2021, China had sent 111 employees to ITER, with 39 holding core positions such as section heads or above, accounting for 5.4% of ITER's total staff. China has also established the ITER Talent Training Base, training over 1,000 management and professional technical talents for ITER.

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4. Problems and Challenges in ISTO Development in China

International scientific and technological organizations serve as important forces in global S&T governance and promoting shared global values, acting as crucial links connecting global innovation resources. As China's depth of participation in ISTO activities continues to increase and its interest in initiating new ISTOs grows, these organizations have made continuous contributions to advancing China's S&T development, enhancing international friendly cooperation and exchanges, strengthening international talent cultivation, and promoting economic and social development. However, China still faces certain problems and challenges in ISTO-related affairs.

4.1. Institutional Guarantees for Initiating, Attracting, and Participating in ISTOs

These include: An ambiguous attitude toward international non-governmental organizations. While China consistently welcomes and supports overseas NGOs, especially international S&T organizations, to operate in China, no consensus has been reached on the attributes, scope, and classification of ISTOs, and the degree of openness and inclusiveness toward ISTOs, particularly overseas NGOs with S&T attributes, remains insufficient. The institutional system for initiating, attracting, or participating in ISTOs needs improvement. China lacks top-level design documents and implementation rules for initiating, attracting, or participating in ISTOs. There remains a tendency to manage non-governmental organizations using methods for intergovernmental organizations, to manage academic organizations using administrative approaches, and to manage overseas organizations using domestic methods. The ambiguity of some management mechanisms and the absence of implementation details hinder the process of Chinese S&T organizations joining ISTOs. Support measures for serving ISTOs are lacking. The approval procedures for ISTOs and their activities are cumbersome, and China's registration, filing, and review processes for

ISTOs still diverge from international rules, limiting the influence and visibility of Chinese S&T organizations on the international stage. Incentive policies encouraging participation in ISTO activities are not detailed or substantive. Although policies supporting S&T workers' participation in ISTOs have been included in national-level documents such as the National Medium- and Long-Term S&T Development Plan, supporting specific policies and corresponding funding remain lacking, affecting the enthusiasm of scientists and S&T workers to participate in ISTO activities.

4.2. Management and Service Systems for ISTO Affairs Need Establishment

These include: A lack of coordinated management and service mechanisms for ISTO settlement. The management authority for ISTO affairs remains unclear, inter-departmental coordination mechanisms are inadequate, and specific regulations for registration and supervision are missing, blocking effective channels for initiating and establishing ISTOs in China. A lack of effective supervision and management coordination mechanisms. Business supervisory departments have limited management and operational experience when promoting related work, coupled with insufficient supervision, management, and risk prevention capabilities for ISTOs, occasionally resulting in problems of "not knowing how to manage," "not wanting to manage," or "not daring to manage," leading to illegal and disciplinary violations by some overseas NGOs. Relevant government departments have not yet reached consensus on the activity fields of international organizations. Classification and categorization of international organizations remain blank, particularly making it difficult to identify S&T international organizations, causing ISTOs to face a "dilemma" of being unable to register or operate because they cannot find appropriate business supervisory units.

4.3. Level and Capacity of Participation in ISTOs Needs Further Improvement

These include: A lack of influential ISTOs. China has few world-important international organization headquarters. Among more than 60,000 international organizations worldwide, approximately 90 have global influence, but only 8 have their headquarters in China. The scale and quality of ISTOs initiated and attracted by China fall significantly short of the goal of building a world science center and global innovation hub. According to the *Yearbook of International Organizations (2018–2019)* published by the Union of International Associations (UIA), among over 3,300 active international S&T organizations worldwide, only 65 have their headquarters in China, compared with 511 in the U.S., 284 in the U.K., and 259 in Belgium and other European and American countries. The degree and level of participation in ISTOs and their activities need enhancement. Chinese experts and scholars' competency for holding positions and performing duties needs improvement. On one hand, Chinese experts and scholars have rel-

atively homogeneous backgrounds, lacking diversified knowledge in economics, law, sociology, and international relations, as well as multi-position experience, which hinders some from holding senior positions. On the other hand, Chinese experts and scholars have insufficient capacity to participate in multilateral affairs such as global agenda-setting and rule-making, easily missing opportunities to voice their opinions on the international stage and affecting China's degree and effectiveness in participating in global governance.

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5. Policy Recommendations for Promoting ISTO Development in China

The 20th Party Congress report states that China should "expand international S&T exchanges and cooperation, strengthen the construction of an internationalized research environment, and form an open innovation ecosystem with global competitiveness." During the 14th Five-Year Plan period, China should create a more internationalized research environment and a more open and innovative research atmosphere, improve ISTO management and service levels in a stable and orderly manner, actively initiate and attract ISTOs, continuously strengthen talent cultivation capabilities for international S&T organizations, and contribute Chinese wisdom to global innovation governance and S&T progress.

5.1. Improve Laws and Regulations for ISTO Development in China

Government departments should promptly formulate laws and regulations specifically for international non-governmental organizations to create a favorable legal environment for ISTO development in China. Accelerate the introduction of detailed rules for ISTO registration in China, and further optimize relevant policies in banking, taxation, and legal protection. Clarify management authority and responsibilities for ISTO settlement in China, and establish a long-term working mechanism led by relevant departments with clearly defined responsibilities. Improve procedures for establishing, changing, and canceling ISTO representative offices, as well as filing annual activity plans, and simplify materials required for representative office registration and temporary activity filing.

5.2. Optimize the Environment for ISTO Settlement and Development in China

The central and local governments should fully learn from international experience by providing venue rental preferences and operational subsidies, reducing or exempting relevant taxes and fees, and offering policy support and financial guarantees for ISTOs to settle and conduct S&T exchange and cooperation activities in China. Accelerate pilot programs for dual certification of medical care and insurance, optimize policies on entry and exit, children's education, and medical security, and create a more comfortable and convenient working and living environment for ISTO employees. Continue research on ISTO-related

issues, promptly identify and resolve problems in the activities of ISTOs within China, and address management gaps and security vulnerabilities.

5.3. Expand the Scope and Channels for Attracting ISTOs to China

The Ministry of Civil Affairs, CAST, and the China Association for Standardization should actively promote the settlement of international societies, associations, and standard organizations in China. For important ISTOs that cannot establish headquarters in China but have mature conditions, efforts should be made to secure their branches. Based on China's advantageous disciplines, such as basic sciences, environmental protection, and medical and health fields with active S&T exchanges, China should proactively create conditions to accelerate the initiation and establishment of a batch of ISTOs. By leveraging regional innovation highlands and open advantages, China should guide the establishment of various new ISTOs in cities or regions with favorable international exchange environments and S&T talent foundations, such as Beijing, Shanghai, and the Guangdong-Hong Kong-Macao Greater Bay Area, which have high degrees of internationalization and attention.

5.4. Strengthen the Cultivation of Personnel Holding Positions in ISTOs and Reserve Candidates

Universities and research institutes should accelerate the enhancement of Chinese experts and scholars' comprehensive capabilities in international laws, etiquette, and diplomacy to remove obstacles for them to hold positions in ISTOs. The Ministry of Science and Technology and CAST should pay close attention to vacancies in key positions in ISTOs and, based on position characteristics, increase publicity and recommendation of competitive candidates through multiple channels. By regularly holding forums for young scholars and international academic conferences, China should build international cooperation and exchange platforms, promote the participation of high-level experts and scholars in the decision-making and management of ISTOs, and support China's S&T community in playing a greater role in promoting S&T progress and participating in global innovation governance.

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Note: Figure translations are in progress. See original paper for figures.