Research on the Development Pathways of Think Tanks in Chinese Science and Technology Associations (Postprint)

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Abstract

[Purpose/Significance] Scientific societies possess distinct advantages for think tank construction. Research on think tank development by scientific societies holds significance for refining theories related to think tank construction and promoting the development of think tanks in China. [Method/Process] Through the collation, analysis, and research of relevant materials on scientific societies and think tanks, the commonalities between the two were identified, and the important role of think tanks within scientific societies was summarized. The SWOT matrix analysis model was employed to analyze the internal and external environments for constructing think tanks within scientific societies. [Results/Conclusion] The analysis reveals that the transformation of scientific societies toward the think tank model represents an inevitable trend, driven by the need to improve the national innovation system, undertake government-transferred functions, and enhance their own competitiveness. Based on this analysis, a pathway model for think tank construction by scientific societies is proposed.

Full Text

Study on the Construction Path of Scientific and Technological Association Think Tanks in China

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Abstract

[**Purpose/Significance**] Scientific and technological associations possess inherent advantages for think tank development. Research on the construction of

such association-based think tanks holds significant theoretical value for refining think tank construction theories and promoting the development of China' s think tank landscape. [**Method/Process**] Through systematic collation, analysis, and research of relevant materials on scientific and technological associations and think tanks, this study identifies commonalities between the two entities and summarizes the important roles of association-based think tanks. The SWOT matrix analysis model is employed to examine the internal and external environments for constructing these think tanks. [**Result/Conclusion**] The analysis reveals that the transformation of scientific and technological associations toward think tanks represents an inevitable trend, driven by the need to improve the national innovation system, undertake government function transfers, and enhance their own competitiveness. Based on these findings, this paper proposes a path model for constructing scientific and technological association think tanks.

Keywords: think tank, scientific and technological association, construction path, SWOT analysis
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China is currently implementing an innovation-driven development strategy and building an innovative nation, which urgently requires a cohort of high-level, specialized science and technology innovation think tanks to support China' s entry into the ranks of world-class innovative countries. Scientific and technological associations possess numerous experts and scholars in various scientific and technological fields, covering engineering science, natural science, and engineering technology, and can play an active role in constructing science and technology innovation think tanks. In September 2015, the China Association for Science and Technology released the "Opinions on Building High-Level Science and Technology Innovation Think Tanks" (hereinafter referred to as the "Opinions"), which proposed gathering and integrating experts and scholars from various societies to leverage the resource advantages of scientific and technological talents from different associations, creating a "small center, large periphery" think tank system for scientific and technological associations. Over the years, scientific and technological associations have achieved certain results in leading scientific and technological progress, promoting disciplinary development, and providing decision-making consultation services for governments and enterprises. Facing the new situation, the transformation of China' s scientific and technological associations toward think tanks can both meet the needs of economic and social development and promote their own development. This paper will explore issues related to the construction of scientific and technological association think tanks in China.

2.1 The Concept of Scientific and Technological Associations

Scientific and technological associations have developed alongside scientific and technological progress, first originating abroad, and after several centuries of development, have now formed a complete and mature system [1]. The earliest

prototype of scientific and technological associations in China can be traced back to the Ming Dynasty. Xing Tianshou, in "China's Earliest Scientific Society," discussed that the earliest known scientific organization in China was the Yititang Zhairen Medical Society, established in 1568, whose purpose, activities, and organizational regulations were all similar to modern societies [2]. During the late 19th and early 20th centuries, as foreign science and technology spread to China, the country also began to establish more formal scientific and technological associations. Han Jinfang, in "Echoes from History," mentioned that the "Mathematics Society," the earliest modern natural science mass organization, was China's first truly meaningful scientific and technological association [3]. Particularly after the reform and opening up, accompanied by the arrival of the "spring of science," the development of China's scientific and technological associations accelerated.

Yang Shujuan divided the development of China's scientific and technological associations into four stages: establishment and exploration, adjustment and transformation, reform and standardization, and innovation and deepening [4]. With the convening of the "Three Science and Technology Conferences" in 2016, China's scientific and technological associations have entered a new period of development.

The role of scientific and technological associations in promoting scientific development has become increasingly important, with numerous scholars conducting research on these associations and providing definitions [5-7]. Scientific and technological associations are social organizations engaged in scientific and technological activities, promoting scientific and technological development, and creating a scientific and technological atmosphere, with members primarily composed of scientific and technological workers, managers, and participants in scientific and technological activities. To promote the development of science and technology, these associations bring together experts for scientific knowledge exchange and academic discussion, thereby advancing scientific progress. Yang Wenzhi defined scientific and technological associations as non-profit social organizations that conduct scientific activities according to certain charters to realize members' common aspirations, with members joining on a voluntary basis [8]. Members of scientific and technological associations come from diverse institutions including enterprises, universities, research institutes, and government departments, giving these associations the characteristics of a "flexible organization."

Wang Chunfa believed that scientific and technological associations are characterized by their cross-industry, cross-disciplinary, and cross-regional nature, representing flexible social organizations formed voluntarily by scientific and technological personnel from different backgrounds to discuss academic issues on a free and equal basis [9]. Liu Songnian and colleagues argued that members of scientific and technological associations could participate in different social organizations simultaneously according to their research tasks, with open organizational boundaries and considerable member freedom [10].

2.2 The Functions of Scientific and Technological Associations

Scientific and technological associations are federations of scientific and technological workers that gather experts and scholars from scientific fields, serving as a critical force in promoting scientific development and technological transformation, and playing an important role in leading scientific and technological progress and social development. These associations represent scientific communities formed voluntarily by scientific and technological workers, promoting disciplinary development and talent growth through academic exchange, project demonstration, and other activities. A scientific community oriented toward "communication" constitutes an important form of existence for scientific and technological associations [11]. Communication and interaction among association members can facilitate knowledge flow. Scientific and technological associations possess knowledge production functions, promoting knowledge generation and flow through collaboration among scientists based on internal member relationships [12]. Diane Vaughan, using rocket booster launcher technology development as an example, demonstrated that scientific and technological associations can exert powerful and sustained influence on the generation, aggregation, processing, exchange, recording, storage, and utilization of knowledge and information [13]. These associations not only promote knowledge production and flow but also bridge the gap between theoretical research and practical application, serving as a transition between theory and practice. The main functions of scientific and technological associations are illustrated in Figure 1 [Figure 1: see original paper].

2.3 Characteristics of Scientific and Technological Associations

The characteristics of scientific and technological associations can be extracted from authoritative definitions and related descriptions. Based on the previous definitional analysis, these associations generally exhibit scientific, academic, non-profit, neutral, and open characteristics [14-15]. The fundamental characteristics are scientific and academic nature. Social nature is an inseparable attribute, as these associations possess the features of social organizations, being non-profit entities voluntarily formed by scientific and technological workers. As cross-departmental and cross-industry academic groups voluntarily formed by scientific and technological workers, they are less influenced or unaffected by government personnel during research, demonstrating their neutrality [16]. For example, reform policies formulated by British scientific and technological associations are often unaffected by political parties and maintain objectivity and neutrality, leading Margaret Thatcher to describe these associations as "people uncorrupted by the old system" [17].

3.1 The Concept of Think Tanks

Since the concept of think tanks was proposed in the 1940s, numerous scholars have studied their definitions, characteristics, and classifications [18-20]. The term "Think Tank" literally means "thought tank." Frank Colbohm defined

think tanks as "idea factories," while other scholars refer to them as "brain banks" or "external brains." Think tanks integrate expertise from multiple experts to provide policy recommendations and decision-making consultation for policymakers. Although academia has not formed a unified understanding of think tanks, there is basic consensus on their organizational forms, work content, and service objects. Think tanks are characterized by objectivity and neutrality, non-governmental nature, non-profit status, non-partisanship, and intermediation [21]. Wang Yanfei believed that modern think tanks also exhibit regularization, institutionalization, and independence [22]. Based on organizational attributes, think tanks can be categorized into official think tanks, semi-official think tanks, university think tanks, and consulting civil (social) think tanks [23]. The Shanghai Academy of Social Sciences Think Tank Research Center classified Chinese think tanks into four major categories: party, government, and military think tanks; academy of social sciences think tanks; university think tanks; and civil think tanks [24]. Global think tanks have developed rapidly. According to the "2017 Global Go To Think Tank Index Report" released by the University of Pennsylvania, there were 7,815 think tanks worldwide in 2017, including 512 in China (accounting for 6.5% and ranking second globally), with the United States ranking first with 1,872 think tanks. Seven Chinese think tanks, including the China Institutes of Contemporary International Relations, were listed among the "Top 100 Global Think Tanks."

3.2 Commonalities Between Scientific and Technological Associations and Think Tanks

(1) **Consistency of Characteristic Attributes.** As analyzed above, scientific and technological associations generally possess scientific, academic, non-profit, and neutral characteristics. Their members mostly come from academic institutions such as universities and research institutes, maintaining scientific, open, objective, and independent positions in their research processes. Meanwhile, think tanks also feature independence, multidisciplinarity, multi-professional fields, and multiple types, with independence and non-profit status being principles universally adhered to by international think tanks. In a sense, the neutrality of scientific and technological associations is consistent with the independence of think tanks. Both are non-profit and do not aim to generate income.

(2) **Consistency of Functions.** Scientific and technological associations can promote the production, flow, application, and diffusion of science and technology, serving as intermediary bridges and knowledge hubs that can transform innovation achievements into productive forces under government guidance [25]. Think tanks act as bridges between "knowledge" and "decision-making." James G. McGann believed that think tank experts and scholars can bridge the gap between theory and practice, apply theoretical knowledge to practice, transform knowledge achievements into productive forces, and realize the value of think tanks by providing in-

dependent and objective solutions to decision-makers [26]. The purpose of theoretical research lies in application, and practical application can promote theoretical research. Therefore, both scientific and technological associations and think tanks serve as "bridges" from theory to practice.

(3) **Consistency of Service Content.** One function of scientific and technological associations is to provide decision-making consultation services for governments and enterprises. Wu Di argued that these associations can provide decision-making consultation services for governments from aspects such as science and technology policy formulation and science and technology project evaluation by leveraging their professional roles in the field of science and technology [27]. Think tanks play important roles in national decision-making and can influence government policy formulation to some extent through their intellectual achievements. The "2014 China Think Tank Report—Influence Ranking and Policy Recommendations" proposed that the main functions of think tanks include policy advice, enlightenment, checks and balances, talent aggregation, and national strengthening. Dickson suggested that think tanks, as groups densely populated with scientific and technological personnel, can conduct interdisciplinary research on social development issues using scientific research methods, provide consultation on policy issues for governments and enterprises, and help governments make correct decisions. As different types of organizations, providing decision-making consultation services for governments and enterprises represents a common purpose for both scientific and technological associations and think tanks.

The commonalities between scientific and technological associations and think tanks are illustrated in Figure 2 [Figure 2: see original paper].

3.3 The Role of Scientific and Technological Association Think Tanks

(1) **Natural Decision-Making Consultation Function.** Scientific nature is crucial in government and enterprise decision-making processes, which require scientific thinking and methods. As academic non-profit organizations, scientific and technological associations gather elites from different research fields, possessing advantages of talent aggregation and intellectual density. They can study and demonstrate the rationality and feasibility of policies from knowledge and technical perspectives, propose solutions and countermeasures, and help decision-makers make decisions. These associations can promote the flow of scientific knowledge throughout society, and the process of knowledge exchange between the scientific community and decision-makers also represents the process of helping governments and enterprises make decisions. Association members generally have their own workplaces, with each member serving as a "node" in the association' s organizational network. Integrating the functions of each "node" and leveraging the overall advantages of the organizational network enables participation in decision-making consultation for governments and

enterprises through multiple approaches [28].

(2) **Provision of Precise Service Content.** When serving governments, scientific and technological association think tanks need to master government information resources, which are mostly used or generated by government agencies in exercising state administrative functions. Association personnel utilize regular flow opportunities between government and think tanks, leveraging the "revolving door" mechanism to timely grasp government information and provide precise services. Association think tanks also maintain close connections with academic research institutions, with some personnel serving as both academic researchers and think tank experts, using their academic research achievements as "food and wealth" for think tanks to utilize when writing decision-making reports [29]. Meanwhile, the construction of association think tanks cannot be separated from modern information technology, and these associations possess certain advantages in utilizing information technologies such as the Internet, big data, and cloud computing, which can improve the accuracy, timeliness, and scientific nature of think tank research achievements.

(3) **Generation of Multi-Disciplinary Multiplier Effects.** Complex problems often require joint cross-disciplinary research, necessitating the participation of experts from different disciplinary backgrounds. The renowned scientist Zhu Guangya once proposed leveraging the collaborative 攻关 role of professional scientific and technological societies, with societies from different industries jointly organizing experts and scholars to research the same topic and applying research achievements to production as soon as possible to promote socio-economic development. As the business supervisory unit of scientific and technological associations, the China Association for Science and Technology has subordinate societies characterized by relatively complete disciplinary categories and numerous involved fields. There are 210 national societies under the China Association for Science and Technology alone, covering almost all fields of natural science and engineering science. When conducting decision-making consultation and technical service activities, association think tanks can utilize the characteristics of each subordinate society in their respective research fields, organize collaborative work among societies, and leverage the multiplier effects of multi-disciplinary approaches.

4 Strengths and Weaknesses in Establishing Scientific and Technological Association Think Tanks

To comprehensively and scientifically analyze the internal conditions and external environment facing the construction of scientific and technological association think tanks, this paper adopts the SWOT analysis method to conduct a comprehensive evaluation of factors influencing think tank construction from perspectives of internal and external factors, constructing a SWOT analysis

model as shown in Table 1 .

The SWOT analysis matrix demonstrates that although scientific and technological association think tanks will inevitably encounter various problems in practice, overall, strengths outweigh weaknesses, and opportunities outweigh challenges. As comprehensive deepening of reforms continues to advance, various social organizations will gradually face market tests. This requires scientific and technological associations to not only leverage their academic functions to promote scientific and technological progress but also to fully realize their knowledge production and external practice guidance functions. From the perspective of business development prospects, transformation into a new-type think tank represents both the internal development need and inevitable survival choice for scientific and technological associations. The construction of association think tanks primarily enjoys the following advantages:

First, scientific and technological associations are composed of technical experts from various industries, serving as carriers of human capital and knowledge capital, and playing a fundamental role in promoting scientific and technological development.

Second, these associations have long maintained close connections with government, having already undertaken some government-transferred functions, giving them unique advantages when playing think tank roles.

Third, there is relevant policy support. To promote the development of scientific and technological associations, relevant departments have issued multiple policies and plans, such as the "Implementation Plan for Pilot Expansion of Orderly Undertaking Government-Transferred Functions by Societies Affiliated with the China Association for Science and Technology."

Fourth, there is specialized personnel guarantee. Scientific and technological associations emphasize exchanges between researchers and government personnel, with many individuals regularly flowing between government, universities, societies, and think tanks, switching roles between researchers and decision participants. This "revolving door" mechanism provides talent guarantees for association participation in think tank construction.

Fifth, there is preliminary experience. Over the years, scientific and technological associations have continuously provided decision-making consultation services for governments, industries, and enterprises, accumulating rich experience in conducting work related to science and technology evaluation, talent evaluation, and key laboratory assessment.

5 The Construction Path for Scientific and Technological Association Think Tanks

The preceding analysis demonstrates that constructing scientific and technological association think tanks is necessary for improving the national innovation

system and undertaking government function transfers, as well as for the associations' own development. This construction requires innovative implementation paths that leverage inherent strengths, break through current dilemmas, enable associations to conduct relevant research under adequate conditions and capabilities, and ensure research findings can effectively help relevant government agencies or enterprises make scientific decisions and promote socio-economic development. The path model for constructing association think tanks is illustrated in Figure 3 [Figure 3: see original paper].

5.1 Establishing Clear Objectives

Scientific and technological association think tanks should focus on solving major and hot issues encountered in national economic and social development, be oriented toward meeting the needs of society, government, and enterprises, and aim to provide high-quality decision-making consultation services. Leveraging the academic, independent, and objective nature of association research work, they should concentrate human, material, and financial resources through resource sharing to provide timely consultation opinions with scientific accuracy and forward-looking perspectives for governments and enterprises. Association think tanks should develop toward specialization and marketization, providing professional consultation for governments and enterprises and cultivating distinctive decision-making consultation brands.

5.2 Building Service Teams

The construction of association think tanks requires both strategic visionaries and general researchers skilled in investigation and data collection. These think tanks gather renowned experts and scholars who have conducted in-depth research in specific areas, bringing them together to serve think tank construction by leveraging their solid foundations, exquisite academic levels, and strategic thinking. The two-way "revolving door" mechanism should be scientifically and reasonably applied to bring national governance experience into association think tanks and bring think tank research thinking into government decision-making departments, achieving benign interaction between government and think tanks.

5.3 Determining Service Content

Associations should leverage their respective strengths to conduct regular investigations on practical issues in national economic and social development and the implementation of major decisions. They should scientifically predict trends in scientific and technological frontiers, accurately grasp development directions in the scientific community, and evaluate basic and applied research achievements in their disciplinary fields. They should actively undertake government-transferred functions, meet government procurement service needs, and participate in the evaluation of government-funded research projects as third parties.

Utilizing their professional advantages, they should conduct science and technology evaluations in areas such as technical standard formulation, technical appraisal, and professional technical title evaluation.

5.4 Utilizing Service Tools

Facing increasingly complex and technical decision-making problems, it is essential to fully employ modern information technology, big data technology, artificial intelligence, and other technical means in think tank construction. Leveraging the inherent advantages of scientific and technological associations in utilizing information technology, they should establish academic exchange platforms, resource transformation platforms, information exchange platforms, and achievement release platforms to continuously advance the informatization construction of association think tanks. In project research, they should employ scientific research tools and methods such as social surveys, bibliometrics, and scenario analysis to ensure the quality of think tank research achievements. Simultaneously, they should innovate new methods, models, and tools for science and technology strategic consultation research to adapt to current economic and social development situations and the needs of science and technology strategy formulation in the information age.

5.5 Outputting Service Products

The ability to produce think tank achievements forms the foundation of think tank academic research capacity and influence, with producing high-quality achievements being the ultimate goal of association think tank construction. Leveraging the intellectual, theoretical, and practical advantages of association think tank experts, they should continuously provide high-quality, "thirst-quenching and practical" research achievements and submit them to relevant government departments or promote them to society to better meet the actual needs of decision-making consultation in various fields. The main forms of association think tank achievements include various government development plans, research reports, evaluation reports, journal articles, decision-making reference theoretical articles, and briefings.

5.6 Establishing Guarantee Mechanisms

Effective communication and cooperation mechanisms should be established to realize mutual exchange among association think tank personnel and between think tanks and service objects. An innovative project-based research mechanism should be created to encourage different societies to jointly conduct research projects according to topic needs. A regular communication and achievement submission mechanism between think tanks and decision-making departments should be established, with channels such as direct suggestion boxes enabling association think tank research findings to timely serve government and enterprise decision-making processes. A scientific and technological association

evaluation index system should be established to regularly assess associations and improve the work quality of association think tanks.

This paper analyzes the commonalities between scientific and technological associations and think tanks in the context of China' s current think tank development status, expounds on the important roles of association think tanks, theoretically demonstrates the necessity, feasibility, strengths, and weaknesses of association think tank construction, and finally proposes a path model for constructing association think tanks oriented toward solving major and complex social problems. However, association think tank construction involves numerous influencing factors, many of which are not considered in this paper and will be further studied in the future.

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