



Study on Analysis of the Structure and Functions of China's Science and Technology Intermediary Agent

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This report is compiled as part of a research that surveyed and analyzed science and technology innovation policies, research and development trends, and associated economic and social circumstances in the Asia-Pacific region. It is being made public on the APRC website and portal site to enable wide use by policymakers, associated researchers, and people with a strong interest in collaborating with the Asia-Pacific region; please see the websites below for more details.

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Executive Summary

In China, Science and Technology Intermediary Agent (STIA) refers to an organization that provides a wide range of support services, including evaluation of science and technology, conversion of scientific and technological achievements into industry (synonymous with "social deployment of research results" as described in Japan), allocation of resources for innovation, policy making for innovation, management consulting for advanced science and technology start-up companies, and financial support. Organizations serving some of these functions existed in the 1950s, but they are government agencies that strictly enforce science and technology policy and are not strictly STIA. In Japan, the Japan Science and Technology Agency (JST), the New Energy and Industrial Technology Development Organization (NEDO), and private institutions perform such work.

The year 2003, when the Ministry of Science and Technology issued "Suggestions on the Positive Development of STIA" can be seen as the first year of policy development for China's STIA. Since the publication of the Opinion, STIA in China have been positioned as an important part of China's science and technology innovation system.

Since the reform and opening-up, strong support from the central and local governments has led to the development of the agents with various roles, such as (1)Incubator, (2) Productivity Promotion Center, (3) Technology Achievement Transformation Center, (4) Technology Property Right Exchange Organization, (5) Science and Technology Financial Service Organization, (6) Patent Agency, (7)Science and Technology Evaluation Organization, and (8)Science and Technology Information Service Organization (The order follows the importance and contribution ranks of the Science and Technology Intermediary Organization.). However, there is no consensus in China on the definition and classification of STIA. The Incubator is recognized as the most important and contributing part of STIA. This is followed by the Productivity Promotion Center, which promotes the industrial transformation of scientific and technological achievements.

The purpose of this study is to clarify the functions of the STIA in the overall R&D process in China and its contribution to scientific and technological innovation and the improvement of industrial technology, as well as to provide basic information for future cooperation between Japanese research institutions and researchers and China. It consists of the following chapters.

Chapter 1: Overview of the STIA

In China, organizations called STIA based on market needs began to develop rapidly after the mid-1980s, but at that time they were government-run or semi-government-run and were constrained by the government sector. This lack of effective competition and disciplinary mechanisms led to a decline in management levels and efficiency, making it difficult to fulfill its intended role.

Subsequently, the fever for entrepreneurship brought about by reform and opening up encouraged the development of STIA, and a style of development characterized by the integration of various institutions' own information and technological resources, in addition to government-led direct investment, emerged.

In 2010, the State Council announced its policy to accelerate the development of the science and technology intermediary service industry to promote scientific and technological innovation and the transformation of scientific and

technological achievements, in addition to launching the fostering and development of strategic emerging industries. The State Council also laid out the direction for the future development of the science and technology intermediary service industry, stating that in 2021, the correct relationship between government and the market will be upheld.

In Chapter 1, we explained (1) a review of the definition and classification of STIA, (2) the evolution and position of STIA in China's R&D system, (3) the development process of STIA, (4) the importance and contribution of each STIA in China's R&D system, and (5) the role of the China Technology Market Association in the science and technology intermediary service industry and its relationship with the government.

Chapter 2: The Role and Contribution of STIA in China's R&D System

Although there is no consensus in China on the definition and classification of STIA, based on the suggestions of the China Technology Market Association, an industry organization, and other relevant parties, eight intermediary agents with diverse functions as described above were included in the survey. We explained: (1) Role, Support Functions, and Activities of STIA; (2) the role of STIA in university-initiated ventures, and the protection and flexible use of intellectual property rights.

Chapter 3: Size, Regional Distribution, and Revenues of STIA

The eight types of STIA mentioned above are described in terms of (1) scale of development, (2) regional distribution, and (3) revenues. In China, there is no consensus on the definition and classification of STIA, so there are currently no coherent statistical data, except for Incubator and Productivity Promotion Center.

Chapter 4: Operation Methods, Characteristics, Successes, and Challenges of typical STIA

We conducted a questionnaire survey of the leading STIAs in China and compiled the following information: (1) organizational structure and overview, (2) cooperation, (3) achievements and areas of expertise, (4) best practices, (5) international cooperation, and (6) challenges and development goals. The following 16 institutions were asked to participate in the survey.

- (1) Incubator
 - 1. Beijing Beihang Tianhui Technology Incubation Co., Ltd.
 - 2. Tianjin Zhihuigu Technology Service Co., Ltd.
- (2) Productivity Promotion Center
 - 1. Shandong Productivity Promotion Center
 - 2. Jiangsu Productivity Promotion Center
- (3) Technology Achievement Transformation Center
 - 1. Beijing Gaoke Qichuang Technological Achievements Transformation Service Platform
 - 2. Xi'an Jiaotong University National Technology Transfer Center
- (4) Technology Property Right Exchange Organization
 - 1. China Technology Exchange Information Service Platform Co., Ltd.

2. Shenzhen United Property And Share Rights Exchanged Co., Ltd.

(5) Science and Technology Financial Service Organization

- 1. China Technology Finance Association
- 2. Inner Mongolia Technology Financing Comprehensive Service Platform

(6) Patent Agency

- 1. CCPIT Patent and Trademark Law Office
- 2. Jinan Shengda Intellectual Property Agency Co., Ltd.
- (7) Science and Technology Evaluation Organization
 - 1. Qingdao Technological Achievements Standardization Evaluation Service Platform
 - 2. Henan Zhongchuang Technology Evaluation Institute

(8) Science and Technology Information Service Organization

- 1. Sichuan Institute of Science and Technology Information
- 2. Beijing Institute of Science and Technology Intelligence

Chapter 5: Challenges and Future Prospects for STIA

The value and significance of STIA is evident in the face of various risks and challenges, such as instability in international industrial chains and geopolitical influences. The Chinese government has made it clear that it intends to shift the leading role in innovation to business, in which STIA is expected to play an important role.

On the other hand, issues such as inadequate policies on STIA and lack of professional (connoisseur) human resources have been pointed out. In addition to reforming the education system, the promotion of science and technology requires addressing the problem of the outflow of scientific and technological human resources overseas and expanding investment of government funds in emerging fields.

Chapter 5 describes (1) the expected contribution of STIA to China's scientific and technological progress and innovation, (2) the challenges and future prospects of STIA in China.

Chapte 6: Findings of Japanese experts on the survey results

The results of this survey were reviewed by four experts.

Reference Materials: Policy Positioning and Support for STIA

In China, 2003 is considered the year of the establishment of STIA, and only since 2015, 14 policies have been issued and implemented at the central level to support the development of STIA. In addition to these, other policies are being developed at the local level based on local conditions. On the other hand, some stakeholders have pointed out the inadequacies of the policy regarding STIA. The transfer of STIA's jurisdiction from the Ministry of Science and Technology to the Ministry of Industry and Information Technology in the reform of the State Council structure announced in March 2023 has also been viewed as a reflection of this situation.

Reference Materials introduces the relevant policies of Beijing, Shanghai, Shenzhen, Tianjin, Shandong, and Guangdong provinces, in addition to the central government-level policies on STIA.

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Introduction

(1) The Stance of "Self-Reliance and Self-Strengthening" in Science and Technology is Made Clear

The ten years following the 18th National Congress of the Communist Party of China in 2012 are perceived as the decade in which China's science and technology made the most progress and exhibited the fastest growth in scientific and technological strength. Amidst this, in response to increased pressure from the United States on China, China clarified its stance on further strengthening "self-reliance and self-strengthening" in science and technology.

On March 5, 2023, President Xi Jinping, participating in the deliberations of the Jiangsu Province delegation at the 14th National People's Congress (NPC), pointed out that accelerating the achievement of a high level of "self-reliance and self-strengthening" in science and technology is a path that must be followed to promote high-quality development. Amidst fierce international competition, he emphasized the need to rely on science and technology innovation, carve out new fields and paths of competition, and create new driving forces and advantages for development.

Furthermore, on March 6, Xi stated that capable and qualified private enterprises should enhance independent innovation and play a greater role in the "self-reliance and self-strengthening" of science and technology and the transformation of scientific and technological achievements. He also mentioned the need to deepen the reform of the science and technology system, vigorously foster an innovation culture, and improve the science and technology evaluation system and incentive mechanisms to create a favorable environment for innovative talents to emerge and fully utilize their skills.

(2) Reorganization of the Ministry of Science and Technology, Strengthening of the Central Party's Guidance and Management Over Scientific and Technological Activities

Xiao Jie, State Councilor (Secretary General of the State Council), explained the State Council's organizational reform on March 7, 2023. The National People's Congress (NPC), equivalent to China's parliament, approved the State Council's organizational reform plan on March 10.

The reorganization of the Ministry of Science and Technology is listed first in the State Council's organizational reforms. In the context of intense international competition and external containment and suppression, the reforms mention a need to further rationalize the guidance and management system for science and technology, plan scientific and technological strength in a more unified manner, overcome difficulties in important core technologies, and accelerate the achievement of high-level "self-reliance and self-strengthening" in science and technology.

Specifically, they mention that the concentrated and unified leadership of the Central Committee of the Communist Party over scientific and technological activities will be strengthened. Namely, a Central Science and Technology Commission will be established under the Central Committee, with its secretariat functions undertaken by the reorganized Ministry of Science and Technology. The Ministry of Science and Technology is positioned as the executive force responsible for strategic planning and management of the science and technology innovation industry chain.

Furthermore, the scope of the Ministry of Science and Technology's jurisdiction will be reduced, with several tasks

previously handled by it being transferred to multiple departments. Specifically, responsibilities such as formulating high-tech development and industrialization plans/policies, guiding the construction of science and technology parks like the National Independent Innovation Demonstration Zone and National High-tech Industrial Development Zones, and guiding the development of the science and technology service industry, technology market, and science and technology intermediary agents will be transferred to the Ministry of Industry and Information Technology. The reorganized Ministry of Science and Technology is expected to focus on policymaking in strategic areas that have been bottlenecks in the development of science and technology, such as basic technologies and semiconductors.

(3) The Remarkable Contribution of Incubators

In China, STIAs have a historical mission to promote economic and social benefits through the transformation of scientific and technological achievements under a market economy, supporting the implementation of an innovationdriven development strategy. The year 2003, when the Ministry of Science and Technology issued the "Suggestions on the Positive Development of STIA," is regarded as the first year of policy development for China's STIAs.

Currently, these organizations serve as specialized STIAs providing services such as technology dissemination, transformation of achievements, science and technology evaluation, allocation of innovation resources, decisionmaking on innovation, and management consulting, acting as carriers of the innovation system with professional knowledge and skills. However, there is no consensus on the classification of STIAs, and among the eight types of intermediary organizations targeted in this report statistical data has only been compiled on incubators and productivity promotion centers.

Amongst STIAs, incubators are recognized as those with the most important and highest level of contribution. As shown in the supplementary table, according to the China Statistical Yearbook on Science and Technology, the number of incubators has steadily increased, from 2,533 in 2015 to approximately 5,971 in 2020, an increase of about 2.3 times. The number of companies receiving incubation services (incubated companies) has also shown an increasing trend, from 102,170 in 2015 to 233,776 in 2020. The cumulative number of companies that have graduated from incubation exceeded 190,000 by 2020.

Furthermore, the annual number of intellectual property applications by incubated companies was just over 100,000 in 2015 but exceeded 300,000 in 2020. Other various indicators, such as the total revenue of incubated companies, the amount of financial aid obtained, and the cumulative amount of venture capital, also indicate that incubators are playing a significant role.

(4) Shortage of Experts (Connoisseurs With Discernment Ability)

Meanwhile, those involved with China's STIAs have observed that related policies and regulations are not sufficiently established, the level of specialization in intermediary services is low, and there is a shortage of specialized personnel. Even limited to after 2015, 14 policies to support the development of STIAs have been issued by various departments. However, Duan Xue, Professor at Beijing University of Chemical Technology (Vice President of Technology Market Association of China (TMAC) and Academician of the Chinese Academy of Sciences), has indicated that the intermediary market operates without standardization due to incomplete regulations.

According to Professor Duan, the professional qualifications of STIA staff have not reached the required level, their capacity to develop the science and technology market is limited, the content of intermediary services is relatively simple, and they are not able to provide timely and effective comprehensive services.

Collaboration between industry, academia, and research requires not only connecting the research outcomes (technology seeds) of universities and others with societal needs but also enhancing the value of technology seeds and creating new value together with researchers. Looking to the future, cultivating expert personnel capable of discerning technology is a must for enhancing the value creation of research and development. China has sought to integrate government, industry, academia, and research through STIAs in the transformation of outcomes, but the challenge of cultivating skilled personnel with discernment abilities remains. A survey conducted among leading STIAs in China also revealed numerous observations about the shortage of specialized personnel.

(5) Promoting the Transformation of Scientific and Technological Achievements Under a New System

As part of its "self-reliance and self-strengthening" in science and technology, China has made it clear that it intends to shift the focus of innovation to companies. In the report presented at the 20th National Congress of the Communist Party of China held in October 2022, a policy was presented to strengthen support for enterprises, enabling them to play a proactive role in science and technology innovation, research and development, and the transformation of scientific and technological achievements.

Currently, enterprises are not the main entities in research and development in China. Professor DUAN Xue mentioned, "STIAs can accelerate technology innovation in enterprises by considering the situation of enterprises, aligning technology resources with internal resources of enterprises, reducing research costs of enterprises, and optimizing the allocation of science and technology resources." At the same time, he pointed out that universities and research institutions do not pay attention to the dissemination and transformation of outcomes, and companies also do not recognize the role of intermediaries.

The recent State Council institutional reform is a decisive move to address a structure that emphasized research but neglected the transformation of results in the practical application of scientific and technological achievements. The responsibility for guiding the development of the science and technology service industry, technology market, and STIAs was transferred from the Ministry of Science and Technology to the Ministry of Industry and Information Technology, reflecting this background. The responsibility for policymaking and implementation related to the transformation of scientific and technological achievements, which the Ministry of Science and Technology had previously undertaken, has also been transferred to the Ministry of Industry and Information Technology is more practical in its approach. Thus, it is expected that the transfer will solve the issue of the lack of reflection of the users' perspective in the formulation and implementation of practical application policies.

Indicator	2015	2016	2017	2018	2019	2020
Number of incubators (for which statistics are available) National level ¹ Non-national level	2533 733 1800	3255 859 2396	4063 976 3087	4849 967 3882	5206 1155 4051	5971 1285 4686
Number of companies being incubated	102170	133286	177542	206024	216828	233776
Total number of graduated companies (companies that have completed incubation)	74853	89694	110701	139396	160850	193935
Average incubation period of graduated companies (months)	20	22	22			

Basic situation of incubators (excerpt)

Source: Based on yearly editions of the "China Statistical Yearbook on Science and Technology"

¹ "National level" refers to intermediary organizations that meet the standards set by the nation and is used for convenience when referring to such organizations. It is utilized for selecting preferential policies such as financial support. "National level" intermediary organizations are considered exemplary. More details will be discussed later.

1 Overview of the STIAs

In China, organizations that perform a wide range of support services, such as transforming scientific and technological achievements from academia into industry, allocating resources for innovation, deciding on policies related to innovation, management consulting for cutting-edge technology startups, and financial support, are called Science and Technology Intermediary Agents (STIAs).

Many universities and research institutions possess some of the service functions provided by these agents, but for functions outside their expertise, such as finance and patents, they utilize services from specialized STIAs. There are no STIAs yet that specialize in specific fields (e.g., information and communication technology or biosciences). There are differences in capabilities among STIAs for each provided service, and the suppliers of scientific and technological achievements, such as universities and research institutions, select the STIAs they receive services from based on their own needs.

The capability of STIAs is influenced by the personnel engaged in their various intermediary services. The acquisition of personnel varies among intermediary agents. For business organizations affiliated with government science and technology management departments, being a civil servant is the minimum condition, and internal selection from a science and technology management department is the main route. Although there has been an increase in recruiting from the general public through staffing companies in recent years, this trend has been limited. Science and technology management departments are also putting effort into personnel training in response to the need for new talent.

Meanwhile, personnel recruitment for private intermediary agencies is primarily through hiring new graduates and mid-career recruitment. For incubators and financial-related personnel, experience and connections are valued, so headhunting is often used.

Qualification certifications, such as the incubator practitioner certification mentioned later, are prerequisites for conducting business. This applies to intermediaries in finance, patent agencies, and others, regardless of whether the intermediary organization is a public business organization or a private entity. Currently, except for new graduates, almost all intermediary agencies require personnel to hold qualifications.

1.1 Review of the Definition and Classification of STIAs²

The science and technology service industry is classified as a "market-oriented practice" that encompasses a series of roles arising from the dissemination, transfer, and application of scientific and technological achievements, including research and development of scientific and technological achievements, information technology, and network technology.

The "Suggestions on the Positive Development of STIA" issued in 2002 first established the concept of STIAs. Following the issuance of these suggestions, **STIAs were classified under the science and technology service**

² Science and technology intermediary services.

industry. STIAs play a significant role in the innovation system of the country and its regions. Based on a market economy system and using specialized knowledge and skills, these organizations provide services such as technology dissemination, transformation of achievements, science and technology evaluation, allocation of innovation resources, and provision of formulation and management consulting regarding innovation policies to all carriers of the innovation system. They act as specialized social service institutions equipped with specialized knowledge and technology.

The classification of the science and technology service industry initially defined by the National Bureau of Statistics in 2005 included research and experimental development, professional technical services, science and technology communication and dissemination services, and geological surveys as the four main categories.

Then, in 2011, with the advancement of informatization, the State Council and the National Development and Reform Commission revised the "Guidance Catalog for Industrial Structure Adjustment (2005 Edition)" to the "Guidance Catalog for Industrial Structure Reform (2011 Edition)", presenting a new scope for science and technology services. Specifically, it comprised 11 major categories, including IT facility management and mobile internet services, informatization construction and software development and operation services, professional technical, certification, and testing services, media and digital content services, emerging science and technology support technology construction, technology consulting and research and development services, planning design and information security services, science and technology information exchange/literature search/science and technology achievement appraisal services, intellectual property rights and investment and financing services, innovation institution construction, and cutting-edge technology services.

By 2015, the National Bureau of Statistics had created a statistical classification for the science and technology service industry, dividing it into seven major categories: science and technology information services, science and technology dissemination-publicity-education services, scientific research and experimental development services, professional technical services, science and technology financial services, science and technology promotion and related services, and comprehensive science and technology services. In 2018, the National Bureau of Statistics compiled a new national science and technology service industry statistical classification based on the national economic industry classification and the national science and technology service industry statistical classification, adhering to the framework of the seven major categories.

The evolution of these classifications shows that the classification of science and technology intermediary services from the perspective of national level managing departments is mainly based on policies and regulations such as the "Suggestions on the Positive Development of STIA" and national standards, holding a certain authority over industry definitions and classifications with relatively clear concepts. However, from the perspective of academic theoretical research and local government policymaking and implementation authorities, there is no consensus on the classification of intermediary agencies linked to the classification of the science and technology service industry in China. Issues such as the divergence of concept definitions, implications, and extensions from empirical rules and statistical data, and the classification standards intertwining with the practice of science and technology intermediary service industry services have been pointed out. Currently, theoretical research on the science and technology intermediary service industry and its classification is being conducted by several academic societies.

The classification of science and technology intermediary services in China has evolved from non-existent to detailed, and its content also intertwines with other science and technology services. Therefore, when conducting academic research and statistics, it is advisable to analyze these services on a case-by-case basis without direct

generalization based on public authority. The state is increasingly valuing the science and technology intermediary service industry, and while the classifications are becoming more detailed, there is a need to further explore the historical background, motivation, and trajectory of changes in classification standards and content.

1.2 The Evolution and Positioning of STIAs in China's Research and Development System

(1) The Birth of STIAs

In China, organizations that perform a wide range of support services, such as evaluating science and technology, transforming scientific and technological achievements from academia into industry, allocating resources for innovation, deciding on policies related to innovation, management consulting for cutting-edge technology startups, and financial support, are called Science and Technology Intermediary Agents (STIAs). These organizations existed in the 1950s, but they were government agencies that strictly enforced science and technology policy and were not strictly STIAs.

The transformation of scientific and technological achievements and intermediary services are closely related. In the transformation process, multiple carriers of innovation (researchers who invent the scientific and technological achievements that form the basis of innovation, entrepreneurs, investors, etc.) must be involved, communicating and negotiating with each other. However, initially, these players are dispersed, and it is impossible for one player to directly assess the resources of another. Furthermore, the transformation of results, which are intangible assets, into practical applications requires rights in the form of intellectual property, research and development for practical use, and fundraising, among others. These activities are challenging for players such as researchers and entrepreneurs to undertake alone, leading to the emergence of intermediary agencies to support these players.

The "Decision of the Central Committee of the Communist Party of China on Reform of the Economic Structure," announced at the Third Plenary Session of the 12th Central Committee of the Communist Party of China held in Beijing on October 20, 1984, pointed out the necessity to develop domestic and foreign markets and various forms of economic and technical cooperation to accelerate the process of China's modernization. At that time, the head of the National Commission for Science and Technology also stated through a Q&A with reporters that it was necessary to develop a technology market domestically and promote the commercialization of technology. As a result, the concept of technology commercialization was established, and some scientists broke free from the traditional constraints of science and technology, establishing private science and technology consulting companies focusing on science and technology services and consulting as their main business. Subsequently, STIAs, which became the buds of a market economy, appeared, exploring the collaboration between industry, academia, and research in the specific business of transforming scientific and technological achievements.

(2) 2003: The Year of Establishment of Science and Technology Intermediary Agents

On December 2, 2002, the Ministry of Science and Technology held the first Science and Technology Intermediary Agent Conference in Beijing. Xu Guanhua, the Minister of Science and Technology at the time, pointed out at the conference that STIAs play an important role in the functional transformation of government departments and in improving their own management and services. He proposed to establish China's science and technology intermediary system within five years, designating the following year, 2003, as the "Year of Establishment of Science and

Technology Intermediary Agents." Subsequently, on December 20, the Ministry of Science and Technology issued the "Suggestions on the Positive Development of STIA", ("关于大力发展科技中介机构的意见") fully recognizing the importance and urgency of developing STIAs and clarifying the principles and objectives of their development at the current stage.

Furthermore, the guiding ideologies, objectives, and principles for the establishment of STIAs were presented, setting them on a course toward organization and standardization. Specifically, the document stated that <u>STIAs</u> are to provide specialized services such as technology dissemination, transformation of achievements, science and technology evaluation, allocation of innovation resources, policy decision-making for innovation, and management consulting to society.

Since then, organizations that had existed in practice transitioned to being officially recognized by policies and supported by the state, moving under the administration of government science and technology departments and being formally established as institutions and organizations that are socially and legally recognized. STIAs became science and technology organizations in this transition to being officially recognized by policies and supported by the state, coming under the administration of government science and technology departments, and being formally established as institutions and organizations to being officially recognized by policies and supported by the state, coming under the administration of government science and technology departments, and being formally established as institutions and organizations accepted at both social and legal levels. Under the cooperation of relevant government departments and the support of related policies, STIAs have rapidly developed and grown, with their market-oriented operations gradually maturing, creating a diverse development situation where the market and government complement each other in aiming for a win-win outcome.

(3) Pillars of the National Innovation System

Since 2003, a significant number of high-level, capable STIAs have emerged, and a high-level science and technology intermediary team is being formed. With the progress of economic system reform, as the decisive role of the market in resource allocation becomes clear, the historical mission of STIAs is to promote the coexistent development of economic and social benefits through the transformation of scientific and technological achievements in a market economy, aiming to support the implementation of an innovation-driven development strategy. In the midst of intense market competition, strong, capable STIAs have risen to the top of the industry and assumed a model role, becoming an important pillar of the national and regional innovation systems.

They are gradually becoming specialized service institutions that serve as carriers of the innovation system, based on the market economy system equipped with specialized knowledge and skills. They provide services such as technology dissemination, transformation of achievements, scientific and technological evaluation, allocation of innovation resources, innovation decision-making, and management consulting. STIAs can offer full process, all-encompassing, and high-efficiency high-quality services such as development testing, loan recommendation and guarantee, venture capital, consulting and training, policy guidance and implementation, and international cooperation, thus producing a brand effect and establishing unique features and specialties in information services, personnel training, corporate diagnostics, quality management consulting, and international cooperation.

In 2014, the State Council issued "Several Opinions on Accelerating the Development of the Science and Technology Service Industry" ("国务院关于加快科技服务业发展的若干意见"), which explicitly categorized STIAs as part of the science and technology service industry. It also pointed out that they are an important part of the modern service industry, characterized not only by their concentration of talent and knowledge, high scientific and technological content, and high industrial added value but also by their leading role.

The State Council also issued "Opinions on Constructing and Improving the Market-Oriented Mechanism for Factor Allocation" ("关于构建更加完善的要素市场化配置体制机制的意见") in 2020, identifying the technology market as one of the five major factor markets³. It underlined the provision of policy support and political guarantees for private organizations and others to enter the science and technology intermediary service industry. The entry of social forces⁴ into the field of science and technology intermediation began with the science and technology consulting and service industry.

In recent years, many universities and enterprises, among other social forces, have begun establishing STIAs. One of the characteristics of this movement is that STIAs are being integrated with the long-term development of these groups. Many social investors have come to understand the transformation of high-tech achievements, moving rationally from the simple purchasing activities of the past to incubation and screening. It is also expected that a virtuous cycle will be realized, such as social forces acting line with market mechanisms and establishing STIAs.

(4) An Era of Government Dependence on STIAs

Through these transitions, the current STIAs, which combine government promotion and market-based adjustments, have become a vital way for government departments to transform their roles and improve their own management and services. Many local government science and technology management departments are not only actively exploring support for the development of STIAs but, in practice, are also boldly transferring local government functions to them and actively seeking advice from STIAs and industry associations in the formulation of their development strategies and major policies. Some of the preliminary selection and review of science and technology projects is being entrusted to STIAs, and policies related to promoting scientific and technological innovation are being implemented through them, effectively resolving the issue of government departments prioritizing policy formulation but not implementation. Government departments recognize the role played by STIAs and are improving not only the efficiency of their management and scientific and democratic policy decision-making but also opening up the potential for the development of STIAs.

1.3 Development Process of STIAs

(1) Government-Led Development After the Reform and Opening Up

Before the reform and opening up process in 1978, the government adopted a method where <u>administrative</u> departments were primarily responsible for allocating resources for science and technology, transforming scientific and technological achievements, and cooperation between industry, academia, and research for economic and social <u>development</u>, in reference to the social development policy of the "Five-Year Plans" based on the Soviet Union's science and technology system.

During the planned economy era, STIAs executed the principle proposed by the State Council at the founding of

³ The "five major factor markets" include the capital market (financial market), labor market, technology market, information market, and real estate market.

⁴ Social forces ("社会力量" in Chinese) refer to the basic units that can participate in and play a role in social development, including natural persons and legal entities (social organizations, political parties and government agencies, non-governmental organizations, non-profit organizations, enterprises, etc.).

the People's Republic of China that "scientific research must serve production." This situation, where administrative agencies took on everything, became the historical starting point for STIAs after the reform and opening up. While subject to historical and cultural constraints, this led to the creation of a development model for government led STIAs.

On the other hand, the market economy demands that government intervention in STIAs be reduced and that individuals and organizations with high capability and passion dedicate themselves to STIAs to ensure their healthy development. Additionally, due to an incomplete market economy system - particularly in situations where government functions were separated from STIAs - high-quality resources were not allocated from the government, resulting in government-led STIAs having an inherent handicap of low service levels, weak market competitiveness, and reliance on the government. This significantly influenced the development of STIAs after the reform and opening up.

(2) Government Dependence as an Obstacle to Development

Since the mid-1980s there has been rapid development of STIAs based on market needs in China. Various types of STIAs, including incubators, productivity promotion centers, technology achievement transformation centers, high-tech zones, engineering technology research centers, and university science and technology parks, were established.

The STIAs established during this period were still in the early stages. They were heavily influenced by the planned economy system, and their management and operating structures were not separated from the government. They also lacked scientificness. In line with international convention, STIAs should operate independently from the government and companies, based on the principle of free will, as social organizations providing specific services through professional knowledge and intellectual labor⁵. In other words, their independence must first be achieved through privatization or "de-governmentalization."

<u>At that time, many STIAs were clearly state-owned or quasi-state-owned.</u> Because the government did not fully transfer the roles that should have been transferred to these STIAs during the functional transformation period, they were constrained by government departments when performing independent supervisory, coordination, and information service roles. This situation meant some STIAs lacked a clear market position and primarily depended on projects being provided by the government. According to industry estimates, 60-80% of the workload of science and technology intermediary services in each province and city was supported by the influence of administrative authorities. As a result of the lack of market consciousness, competitive consciousness, and service consciousness, there was no effective competition or disciplinary mechanisms, leading to a decline in management level and efficiency. It was, therefore, very difficult for STIAs to fulfill their original roles.

(3) Segmentation and Specialization of Science and Technology Intermediary Services

In the early stages of the market economy, the enthusiasm for entrepreneurship brought to local governments and individuals through the reform and opening up process helped promote the development of STIAs. With the continuous reform of the science and technology system and the continuous transformation of government functions in the 1990s, STIAs in China maintained a rapid increase in numbers. In addition to direct investment by government-

⁵ A social organization is a collective of people cooperating according to certain fundamental principles, systems, and structures to achieve specific goals. They include political parties, governments, companies, shops, factories, schools, etc., and are designed to coordinate the activities of their members with clearly defined boundaries, purposes, and roles, and formal relational structures.

led initiatives, a development style characterized by the integration of various institutions' unique resources, including information and technology, emerged. In 1993, Shanghai Technology Exchange, China's first permanent technology market, was established, followed by the emergence of 10 major technology exchanges nationwide⁶, marking the beginning of the segmentation of technology intermediary services from comprehensive technology services.

Entering the 21st century, the knowledge-intensive service industry of developed countries, represented by the United States, began to shift on a large scale to developing countries with advantages in intellectual talents, ushering in a massive transition wave to the global service industry. The international trade of services has shifted from traditional services to professional technical services, with the large-scale transfer of global services triggering a new global industrial reorganization. This shift is expected to bring benefits favorable to service trade exporting countries, becoming one of the focal points of competition in the 21st-century global economy. With the rapid development of the service industry in Western developed countries, especially the continuous advancement of segmentation and specialization, the service level of the science and technology intermediary industry has rapidly increased, and its range of services is expanding. The development of STIAs, in the context of WTO membership and the market economy, is not only an objective necessity to accelerate economic construction and social development but also a significant effort as part of participating in the process of economic globalization and responding to global science and technology challenges.

(4) Development of Strategic Emerging Industries Expands Market Needs

<u>Since 2010</u>, strategic emerging industries have been expected to stimulate the economy and become an important means of structural adjustment and mode transformation. Many advanced countries have begun accelerating new strategic products. In the competitive environment for the development of emerging industries, China has been gradually clarifying its commitment to strategic emerging industries, focusing on the necessity of long-term development and combining growth maintenance with structural adjustment.

In October 2010, the State Council issued the "Decision on Accelerating the Cultivation and Development of Strategic Emerging Industries" ("关于加快培育和发展战略性新兴产业的决定"), pointing out how vital enhancing autonomous innovation capabilities is for the cultivation and development of strategic emerging industries and the construction of an industrial innovation support system. Leveraging the support functions of knowledge-intensive service industries centered on STIAs requires vigorously developing high-tech services such as research and development services, information services, entrepreneurial services, technology transactions, transforming intellectual property rights and scientific and technological achievements, as well as business services like HR services, investment, and management consulting. Therefore, the development of strategic emerging industries produces a strong need in the market for STIAs to develop.

Consequently, in 2014, the State Council proposed in "Several Opinions on Accelerating the Development of the Science and Technology Service Industry" to accelerate the development of the science and technology service industry. This approach is pivotal for fostering scientific and technological innovation and the transformation of its

⁶ The 10 major technology exchanges: Shanghai Technology Exchange, China Technology Exchange, Shenzhen United Property Rights Exchange, Chongqing United Assets and Equity Exchange, Jiangsu Property Rights Exchange, Inner Mongolia Property Rights Trading Center, Shandong Property Right Exchange Centre, Tianjin Property Rights Exchange Center, Wuhan Optics Valley United Property Rights Exchange, and Southwest United Property Rights Exchange.

outcomes, promoting a deep integration between science, technology, and the economy. It also plays a crucial role in adjusting and optimizing industrial structures to nurture new economic growth points. In addition, advancing industrial sophistication through scientific and technological innovation helps elevate the economy to a mid-to-highend level. Implementing an innovation-driven development strategy and enhancing the quality and efficiency of the economy are of significant importance in this process.

Additionally, it mentioned the need for policies to emphasize the development of specialized and comprehensive science and technology services, including research and development, technology transfer, testing, inspection, certification, incubation, intellectual property rights, science and technology consulting, science and technology finance, and science and technology dissemination. Looking forward, the proposal also noted a need to strengthen the credit system for science and technology service enterprises, build a unified and open market system with competitive order, and establish a fair, competitive environment for various science and technology service providers.

(5) A Focus on Building a Market System

In 2020, the 4th Plenary Session of the 19th Central Committee of the Communist Party of China emphasized promoting market construction, realizing market-determined pricing, autonomous and orderly mobility, and efficient and fair allocation. This holds significant importance in accelerating the improvement of the socialist market economic system, constructing a high-level market system, and promoting high-quality economic development. In recent years, although China's commodity market has achieved sufficient growth and significant progress in market construction and reform, the development of markets for land, labor, capital, technology, and data is relatively lagging compared to the commodity and service markets.

In 2021, the State Council issued the "Guiding Opinions on Improving the Evaluation Mechanism for Scientific and Technological Achievements" ("完善科技成果评价机制的指导意见"), presenting the future direction for the development of the science and technology intermediary service industry. This directive aims to respond to the advancement of the market system, correctly handle the relationship between the government and the market, establish a diverse evaluation system for outcomes assessment, and form a favorable innovation ecosystem.

The guidance explicitly states the importance of maintaining the correct relationship between government and market. It emphasized fully leveraging the decisive role of the market in resource allocation, further utilizing the role of the government, introducing third-party evaluations, and accelerating the construction of the technology market. Additionally, it mentions accelerating the construction of a pluralistic evaluation system involving the government, social organizations, enterprises, investment and financing institutions, etc., to fully adjust the proactiveness of each evaluation entity and create an innovation ecosystem suitable for achievement evaluation.

The guidance also acknowledges the substantial value of scientific and technological achievements and seeks to eliminate the pitfalls of evaluating achievements based only on "publications, titles, educational background, or awards". It aims to establish objective criteria for the evaluation of STIAs, raise the evaluation standards for industrialization and economic benefits, and introduce diverse transaction models for the science and technology achievements market, such as sound negotiated pricing, public listings, auctions, and asset evaluations.

It also calls for the establishment of a national technology transaction information dissemination mechanism, promoting interconnectivity of information and data regarding technology transactions, scientific and technological achievements, and technology contract registrations based on the law. Additionally, it aims to create an evaluator

development mechanism centered on technology agents⁷, encouraging technology transfer organizations⁸ and technology agents to participate in the entire process of invention disclosure, evaluation, and face-to-face negotiations and to carry out specialized evaluation activities of scientific and technological achievements for the market.

(6) Contributions in Response to COVID-19

In 2020, many companies faced a crisis from value chain disruptions due to the impact of COVID-19, including science and technology-type small and medium-sized enterprises⁹. Although the resumption of business activities by upstream and downstream companies in the value chain was not synchronized, STIAs significantly contributed to solving difficulties in business operations and the plight of weak demand upstream.

According to the China Technology Market Association, <u>the technology intermediary service industry has been</u> closely monitoring the COVID-19 pandemic and industry information dynamics in real-time, adjusting activities accordingly, balancing the allocation of scientific and technological innovation resources between large and small enterprises, improving and innovating the current mechanism for the transformation of scientific and technological achievements, and making numerous attempts to connect technical, financial, application, and market aspects to the transformation or transfer of scientific and technological achievements.

Industry associations such as the Zhongguancun Incubators Development Alliance (中关村科技孵化器发展联盟) in Beijing and the China Technology Market Association have surveyed needs from the service and science and technology intermediary service industries and expressed their hope that the government will introduce related support measures and strengthen financial support for the science and technology intermediary service industry through discussions with the Beijing Municipal Science and Technology Commission and the Ministry of Science and Technology, including the desire for long-term loans and interest rate discounts on existing loans. In particular, science and technology-type small and medium-sized production companies, which are clients of STIAs, have specifically requested progressive exemptions or reductions in corporate tax, subsidies for rent and utilities, and employment subsidies for stable employment from the government.

STIAs are actively seeking reforms within the industry in the face of the COVID-19 pandemic and the challenging situation it is creating surrounding transforming outcomes. STIAs in the Yangtze River Delta region, such as Shanghai, Jiangsu, and Zhejiang, have expanded customized services for the supply of technological achievements based on technology achievement information sharing service platforms, strengthening effective connections between the supply and demand sides in the science and technology market.

Based on provincial-level STIAs, regions are constructing a technology transfer system combining technology transaction management organizations (technology market management agencies and technology contract certification registration agencies, etc.), scientific and technological achievements transfer and transformation demonstration

⁷ Technology agents ("技術経理人") are individuals with a technical background who can discern the technical level and application scenarios of scientific and technological projects, assist scientists in finding suitable partners, help set up entrepreneurial teams, and are knowledgeable about the laws, regulations, and operational procedures related to the transformation of technical achievements.

⁸ Technology transfer organizations refer to institutions that provide various services to realize and accelerate the transfer process from the supply side to the demand side of technology, serving as an important component in promoting knowledge flow and technology transfer in the technology innovation system.

⁹ "Science and technology-type" small and medium-sized enterprises refer to companies with relatively high technological content in their products and possessing core competitive strengths.

zones (e.g., national technology transfer regional centers¹⁰, national technology transfer demonstration institutions, innovation stations, etc.), and national scientific and technological achievements transformation guidance institutions (national scientific and technological achievements transformation guidance funds, national-level incubators, etc.).

In addition, investments in scientific and technological innovation and transformation by local governments, introduced based on the "Guiding Opinions on Improving the Evaluation Mechanism for Scientific and Technological Achievements," enhance diverse investments and joint innovation by government, industry, academia, and research, leading to the advancement of STIAs and actively responding to the impact of the COVID-19 pandemic on industry.

1.4 Importance and Level of Contribution of Each STIA in China's R&D System and the Targets of this Report

As mentioned in 1.1, there is no consensus on the classification of STIAs. However, this survey, taking into account the opinions of the China Technology Market Association¹¹, divides them into the following eight classifications. The importance and contribution of each STIA in China's research and development system were confirmed by the China Technology Market Association. According to the Association, although there is no clear standard in the industry regarding the importance and contribution of STIAs, when analyzed from the perspectives of the physical space size and online space availability, the level of service systems and system completeness, the scale and amount of individual cases of technical achievements, and the influence of these cases, and referring to the evaluation criteria of the China Technology Market Association's Jin Qiao Award¹² given to individuals or organizations that have made outstanding contributions in the national technology market, the importance and contribution rank of the eight STIAs targeted in this survey are as follows:

<u>This research study targets the following eight STIAs.</u> The functions of each organization will be detailed in "2 The Roles and Contributions of STIAs in China's R&D system".

- ¹⁰ Technology transfer regional centers: Refer to section 3.3 "Technology Achievement Transformation Centers" (2) Regional Distribution.
- ¹¹ China Technology Market Association: Established jointly by the government and the Chinese Academy of Sciences in 1992, it promotes the construction of the legal system of the technology market, standardizes transaction behavior, etc. It is a national-scale industry association with independent corporate status whose work is guided by the Ministry of Science and Technology.
- ¹² The Jin Qiao Award is granted to organizations, individuals, and projects that meet the award requirements. Provincial (municipal) science and technology departments, relevant ministries and commissions of the State Council, science and technology departments overseeing the industry, and related associations recommend candidates to the Jin Qiao Award judging committee. It encourages advanced groups, individuals, and projects that have made significant contributions to the domestic technology market. It was established in 2002 with the approval of the National Office for Science and Technology Awards. There are first prize, second prize, and excellence awards for organization, individual, and project categories, held once every two years.

Rank and description of the importance and contribution of each STIA

Rank of Importance and Contribution	Organization Name	Description of the Organization
1	Incubators	By providing physical space and infrastructure, as well as various services, to newly established science and technology-type small and medium-sized enterprises, incubators reduce entrepreneurship risks and costs, increase the success rate of startups, promote the transformation of scientific and technological achievements, and help the growth and development of these enterprises. Expressions such as "business incubator" (" 企業孵化器 ") and "science and technology business incubator" (" 科技企業孵化器 ") are also used, but they all have the same meaning.
2	Productivity Promotion Centers	Mainly serve small and medium-sized enterprises and township enterprises ¹³ , by organizing scientific and technological forces (technology, achievements, personnel, information). They provide services in various ways, promote technological progress, and improve the market competitiveness of each enterprise.
3	Technology Achievement Transformation Centers	Play a role in testing, developing, applying, and popularizing scientific and technological achievements with practical value obtained from scientific research and technological development until new products, processes, and materials are formed and new industries develop to improve productivity levels.
4	Technology Property Right Exchange Organizations	Serve as a bridge between technology and capital, promote the industrialization process of scientific and technological achievements, and promote socio-economic development.
5	Science and Technology Financial Service Organizations	Help promote the integration of science and technology with finance, solve the financing difficulties and high loan issues of science and technology- type small and medium-sized enterprises, and promote the transformation of scientific and technological achievements. To enable these aims, these organizations have been established in various places.
6	Patent Agencies	A service organization approved by the National Intellectual Property Administration after review by the provincial patent administration, which, upon commission by the client, handles patent cases such as patent applications on behalf of the client within the scope of commissioned authority.
7	Science and Technology Evaluation Organizations	Conduct specialized consultations and evaluations on science and technology policies, plans, projects, achievements, institutions, personnel, and activities. These evaluations are carried out in accordance with the client's specific objectives, following certain principles, procedures, and standards.
8	Science and Technology Information Service Organizations	In addition to providing information services to governments and companies, these organizations also engage in information research, statistical analysis, management of science and technology information databases, analysis of technology economic policies, software development, website construction, and multimedia design and production.

Source: China Technology Market Association

¹³ Township enterprises: A general term for rural enterprises that rapidly increased in China after the dissolution of the people's communes around 1985.

1.5 Role of the China Technology Market Association in the Science and Technology Intermediary Service Industry and its Relationship with the Government

(1) The Expanding Role of Industry Associations

The role of industry associations, which help promote the development of STIAs, is beginning to increase. Because the quality, effectiveness, and fees of intermediary services are often difficult to measure by traditional methods, the reliability and norms of the industry are indispensable for the development of these services. One of the success stories of advanced countries is the establishment of industry associations to ensure and improve the reliability of industries and maintain industry discipline by implementing industry self-regulation.

<u>The China Technology Market Association is a nationwide-scale industry association with an independent</u> <u>corporate status</u> whose work is guided by the Ministry of Science and Technology, jointly initiated and prepared for establishment by the State Planning Commission, the State Economic Commission, the State Science and Technology Commission, the Commission for Science, Technology and Industry for National Defense, the State Education Commission (at the time), the Chinese Academy of Sciences, etc. It actively promotes scientific and technological innovation and entrepreneurship, proactively carries out personnel training for technology services and technology market construction, promotes the construction of modern technology market legal systems, standardizes transaction behaviors, and also actively contributes to maintaining the operational order of the technology market.

<u>The establishment of science and technology intermediary industry associations is being promoted regionally</u>, and some initial results are being seen. For example, in Beijing, Shanghai, Tianjin, Jiangsu, Sichuan, and Hunan, associations of the science and technology consulting industry have been established, and an industrial management system including industry norms, certification methods for science and technology consulting organizations and consultants, staff service guidelines, and annual qualification inspections has been established, with strict evaluation, review, certification, and follow-up management being conducted. At the same time, personnel training, information exchange, and external cooperation are also actively carried out, playing a bridging and connecting role between the government and STIAs.

(2) The Role of the China Technology Market Association

Currently, the association has over 400 organizational members, including more than 10 branches such as the Science and Technology Market Advisory Committee, the Youth Science and Technology Innovation Work Committee, the Construction Special Committee, the Bonded Material Technology and Market Special Committee, as well as direct organizations like the Science and Technology Service Center, the Science and Technology Evaluation and Advisory Center, and the China Technology Market Information Port, collaborating with a wide range of layers including science and technology, education, economy, management, enterprises, and businesses.

The association primarily conducts the following activities:

(1) Propagates and implements laws, rules, guidelines, and policies related to science and education, the technology market, and the transformation of scientific and technological achievements in alignment with the strategies of the party and the nation. Carries out activities for the protection of intellectual property rights, publicity, and consulting of related regulations and policies. Reports the demands and legitimate requests of member organizations while conveying and executing the government's directives and intentions. Protects the legitimate rights and interests of

those involved in technology transactions, especially member organizations.

(2) Conducts theoretical research on the technology market, organizes academic exchange activities related to the technology market, makes suggestions to the government's policy-making bodies regarding technology market policies and development plans, and provides policy consulting on the development of the technology market. Edits and publishes the journal "China Technology Market" and other academic publications based on related regulations. Carries out surveys and research on the technology market, summarizes and exchanges practical experiences, organizes various seminars and symposiums, and produces papers. Collaborates with related organizations and individuals overseas to conduct academic exchanges.

(3) Organizes training on technology market operations, lectures on laws, regulations, and related policies concerning the technology market and the transformation of scientific and technological achievements, technology transfer, and technology services. Conducts training on international and domestic developments in science, technology, and the economy, along with related management and operational knowledge, practical experience and professional qualifications and qualities. This training aims to promote the establishment of access mechanisms to the technology market and enhance education on building teams of professionals in areas such as technology market policies and regulations, technology agents, science and technology consulting, evaluation services, and standardization development.

(4) Promotes the transfer of technology and the transformation of technological achievements into substantial productivity improvements. Collects and disseminates information on technology assets and related services. Organizes domestic and international diffusion and application, exhibition, and transaction activities for technologies/ products according to the approval of government departments or the development needs of the industry. Organizes the joint development, diffusion, and application of high-tech. Provides technical services such as valuation of technology achievement transfers, planning proposals, innovation, business plans, feasibility studies, market outlook analysis for businesses, etc. Conducts international cooperation and exchange in technology transfer.

(5) Undertake service procurement by government departments or conduct the following activities with the approval of related government departments.

- Demonstrative evaluation and review of technological achievements

- Selection of the China Technology Market Association's Jin Qiao Award and related awards

- Organizes the formulation and implementation of codes of conduct in line with international practices, technical/ product standards, norms for practitioners, qualification certification, and reliability evaluation.

(6) Carries out other business entrusted by government agencies and related departments to promote technology transfer and the development of the technology market.



The Structure of China's STIAs

Source: Created by Tepia Corporation Japan based on opinions from China Technology Market Association affiliates



Source: Created by Professor Duan Xue from Beijing University of Chemical Technology

2 The Roles and Contributions of STIAs in China's R&D system

2.1 Roles, Support Functions, and Activities of STIAs

2.1.1 Incubators (孵化器)

(1) Overview

According to the related provisions of the <u>Science and Technology Business Incubator Management Measures</u>¹⁴ promulgated and implemented by the Ministry of Science and Technology in 2019, <u>an incubator is an important</u> component of the national innovation system that provides physical space, shared facilities, and specialized services with the aim of promoting the transformation of scientific and technological achievements and nurturing science and technology-type enterprises and entrepreneurs, as well as a science and technology entrepreneurship service organization that serves as a platform supporting mass innovation and mass entrepreneurship¹⁵.

Furthermore, the main role of incubators is to focus on the growth needs of science and technology-type enterprises, gather all kinds of factor resources¹⁶, promote innovation and entrepreneurship based on science and technology, and provide services such as entrepreneurial venues, shared facilities, technical services, consulting services, investment and financing, entrepreneurial guidance, resource matching, etc., aiming to reduce entrepreneurial costs, improve the survival rate of startups, promote the growth of companies, encourage employment through entrepreneurship, and invigorate overall societal innovation and entrepreneurial vitality.

(2) Cultivating Large Numbers of Science and Technology-Type Enterprises

The Ministry of Science and Technology's Torch Center ("火炬高技术产业开发中心") published the China Entrepreneurship Incubation Development Report (2022) in September 2022. According to the report, <u>the active intellectual property rights of companies/teams incubated by Chinese incubators in 2021 amounted to 1.41 million cases, and the research and development expenditures of incubated companies totaled 83.147 billion yuan. The number of science and technology-type small and medium-sized enterprises receiving incubation services increased by 28.9% compared to the same period in the previous year, and high-tech enterprises increased by 11.1%.</u>

Among the companies that graduated from the incubation period and graduated from the incubator, 6534 companies

Expressions such as Business Incubator and Science and Technology Business Incubator are also used but there is no substantial difference between them.

¹⁵ "Mass entrepreneurship,""mass innovation": Previously, the main actors in innovation were technicians with specialized knowledge in research and development institutions, and elites with abundant financial resources and social networks, but the government is calling for support for entrepreneurship amongst general technicians and low- and middle-income earners, not just high-status elites. This was expressed by Premier Li Keqiang at the Davos Conference in 2014.

¹⁶ As production factors, labor, land, capital, science and technology, information, etc., are included.

were listed/publicly announced. Amongst companies listed on the STAR Market¹⁷, 103 had graduated from incubators, accounting for one-fourth of the total. Incubators have given birth to powerful technology companies such as iFlytek, Daan Gene, SinoHytec, and Trina Solar. In addition, science and technology-type companies in industrial robots, new energy vehicles, integrated circuits, microcomputers, etc., have become trendsetters of the science and technology entrepreneurship boom. Incubators, serving as the cradle of growth for science and technology-type companies, have quickly nurtured and developed these new industries by gathering various factors of innovation and entrepreneurship, including the aforementioned industries.

(3) Contributing to Regional Economy, High-Tech, and Strategic Emerging Industries

The incubator construction model in China was introduced and established from the West and led to the practical leveraging of China's unique characteristics. The physical space of China's incubators significantly surpasses that of the West, and not only is the number of incubated companies continuously increasing, but the positioning of incubators has also gradually leaped from the classical theory of facilitating the transformation of scientific and technological achievements and the cultivation of entrepreneurs to contributing to the regional economy, high-tech industries, and strategic emerging industries.

The incubation service chain, catering to the needs of service recipients and the regional economy, is structured from the pre-incubator stage, known as an entrepreneurial nursery,¹⁸ to incubators, and then to accelerators ("Enterprise Accelerator"¹⁹), which aim to fast-track the growth of high-growth science and technology-type companies, all centered around the development from technology projects to industries. Furthermore, each incubator extends its service reach beyond the physical concept of an incubator to a broad group of "science and technology type" small and medium-sized enterprises, becoming carriers of the regional innovation service system.

Incubators provide comprehensive support and assurance at all aspects of the research and development process. Firstly, basic services, namely office space and real estate management services, are fundamental functions provided by all incubators. Secondly, business services, including company registration, policy declaration, investment matching, management consulting, and exchange activities, among others. Many incubators offer these services, but the level of service varies depending on each organization's resource capabilities and priorities. Thirdly, specialized services are mainly provided by specialized technology incubators, focusing on specific technology fields and offering specialized support services such as production facilities, specialized laboratories, specialized supply chains, and training of experts in vertical fields. High thresholds necessitate dedicated investment or resources accumulated by incubators. Due to differing resource capabilities, incubators across various locations offer services with unique emphases based on their service level.

By constructing a "physical space + specialized services" three-dimensional service system, a sophisticated service system centered around incubators has been formed, maximizing resource integration and enhancing the efficiency

¹⁷ A new stock market opened by the Shanghai Stock Exchange in July 2019. "STAR" refers to science, technology, and innovation. It aims to channel growth funds into industries such as semiconductors, medical/bio, military industry, etc.

¹⁸ Entrepreneurial Nursery: An important component of the incubation chain, it extends the business scope of traditional incubators to an earlier stage, also known as pre-incubator. It refers to entrepreneurial carriers that provide pre-incubation services such as free office space, basic business services, and entrepreneurial guidance to entrepreneurial projects.

¹⁹ Accelerator ("Enterprise Accelerator"): A new service network, mainly serving rapidly growing companies, aiming to fully meet the individual needs of companies in terms of space, management, services, and cooperation through service model innovation.

of intermediaries and specialized institutions. Furthermore, incubators benefit from the geographical concentration or proximity of upstream and downstream resources of the same or related industrial chains and the close collaboration between research organizations, creating an objective atmosphere for learning and exchange, which is highly advantageous for the growth and industrialization of research results.

Technology research and development are characterized by significant investment, high risk, and long lead times, with many venture capital institutions focusing on companies nearing listing. Incubators intervene in the research and development process from the early stages of entrepreneurship, gaining a deeper understanding of R&D situations and providing early-stage investment and support for the industrialization and practical application of technological achievements. Similarly, incubators, while incorporating scientific and technological achievements for incubation, also make seed-stage investments and support startups²⁰ not only financially but also through specialized management teams aiding in technology and market development. For incubators, investment as shareholders through incubation and the subsequent reward from this investment enhances the motivation for providing incubation services, creating a virtuous cycle for the incubator.

(4) Activities

(1) Building a platform for government-industry-academia-research-users

Over 20 years of development in China, incubators have evolved from a 1.0 version of just providing space to a 2.0 stage of offering "space + services," and then to a 3.0 era of "space + services + capital". They are currently entering the 4.0 era, focusing on industry-oriented, capital-accelerated innovation, building a complete innovation ecosystem propelled by industry-academia-research collaboration.

Incubators have established mechanisms and platforms for cooperation among government-industry-academiaresearch-users, integrating industry and education, science and education, joint personnel training, and co-innovation. They are actively promoting the formation of an effective innovation resource sharing and benefit distribution mechanism among universities, research institutions, and companies through government-industry-academiaresearch-users, encouraging close cooperation between related industries' companies and universities under guidance from policy. By promoting the transformation of university scientific and technological achievements through innovation-led and collaborative innovation, market-oriented incubators have unlocked the value of university innovation outcomes and enabled users to amplify that value, forming a series of feasible mechanisms in which endusers participate.

Specifically, incubators act as the primary agents. Working in collaboration with governments and industryacademia liaison organizations, they conduct research on industry-academia-research policies, as well as research through their built-in service organizations, ensuring research results are put to practical use. This includes practical applications for the development of technical universities and personnel training, scientific research, social services, and cultural inheritance. The results are also utilized in government policy formulation and contribute to regional economic construction, corporate development, and the improvement of the ecological chain for the transformation of scientific and technological achievements through both theoretical construction and practice, supporting research

²⁰ Startups refer to newly established companies without sufficient capital or resources, facing challenges such as funding shortages and personnel shortages (usually just the founder and a few core employees) and struggling with business development.

teams and innovation entrepreneurs.

Furthermore, in collaboration with universities, incubators have produced a unique entrepreneurial ecosystem, nurturing students' spirit of innovation, entrepreneurial mindsets, and innovation and entrepreneurship capabilities. In addition, curricula for innovation and entrepreneurship education within universities are being improved. Entrepreneur banks and maker spaces²¹ are also being constructed, along with innovation and entrepreneurship salons. Guidance and encouragement are also being provided for central figures in university research, successful entrepreneurs, renowned business managers, angels, venture capitalists, and experts, enabling them to serve as part-time entrepreneurship mentors. Incubators provide entrepreneurship guidance, including business plans and channels, implementing a wide range of educational methods such as inspirational, discussion-based, and participatory education, incorporating the latest international academic developments, cutting-edge research results, and practical experiences into education, fostering students' critical and creative thinking, and inspiring innovation and entrepreneurship.

(2) Enhancing industry-academia-research collaboration efficiency with financial institutions

Incubators also play a role in actively guiding and promoting industry-academia-research collaboration. Frontier innovation technologies, which are characterized by uncertainties and unknowns, incentivize companies and university research forces to actively participate in product innovation, fostering a continuous innovation mindset. This involves cultivating ideas, inspiration, and a technological culture between corporations and university research forces for continuous innovation and utilizing this as a practical platform for training personnel who are able to innovate.

Recently, incubators have been actively considering introducing financial institutions and intermediaries, aiming to form a joint innovation network by increasing nodes in the co-innovation network and achieving true information and resource sharing. Financial institutions, with their information processing and risk diversification functions, facilitate fundraising for projects and provide various forms of financial support for technological innovation. Other intermediaries and industry associations offer various social services to companies, such as information exchange, consulting services, and knowledge integration, serving as crucial bridges for the flow of knowledge and technology transfer between government, companies, universities, research institutions, and the market. Therefore, incorporating financial institutions and intermediaries into the joint innovation system platformed on incubators can further enhance the efficiency of industry-academia-research collaboration and increase the rate of achievement transformation.

2.1.2 Productivity Promotion Centers (生产力促进中心)

(1) Overview

According to the "Productivity Promotion Center Management Measures" ("生产力促进中心管理办法") promulgated and implemented by the Ministry of Science and Technology in 2005, <u>Productivity Promotion Centers provide</u> <u>scientific and technological intermediary services to enterprises while supporting the technological innovation of</u> <u>small and medium-sized enterprises, promoting the transformation of scientific and technological achievements, and</u>

²¹ Maker Space: Refers to a workspace operated by a community where people with common interests (usually in computers, machinery, technology, science, digital art, electronics, etc.) can meet, interact, and collaborate.

facilitating bridges between enterprises and government, enterprises and research institutions or universities, and enterprises and the market, improving the innovation capability, management level, and market competitiveness of enterprises, especially small and medium-sized enterprises.

In the research and development stage of scientific and technological innovation, Productivity Promotion Centers primarily focus on leading and advantageous industries in the region, establishing public service platforms for research and development services, promoting the research and development of important technologies common to industries, and encouraging the diffusion and application of advanced technologies. They also provide management services for national, provincial, and municipal science and technology programs. Specifically, services include:

(2) Diverse Services

(1) Information Services

Providing information services related to technology, economy, policy and regulations, markets, and talent, tailored to the needs of research and development organizations. The construction of a science and technology information consulting network and the development of databases for science and technology information, talent in science and technology, scientific and technological achievement projects, and corporate needs. These are then used for information search consulting by research and development organizations on scientific and technological materials, achievements, product supply and demand, corporate information, and talent recruitment. Offering consulting services for cooperative information, online technology and product transaction intermediation, and dissemination of supply and demand information to research and development organizations.

(2) Training Services

Productivity Promotion Centers provide specialized training and education in areas such as the Torch Plan ("火炬")²² and Spark Plan ("星火")²³, dissemination of scientific and technological achievements, and technology economics. They also develop projects for specialized training and education aimed at common technological improvements, as well as for management, providing a wide range of talent development and training services that contribute to the technological advancement of research and development organizations.

(3) Technical Services

Productivity Promotion Centers provide technical support services to help enterprises introduce advanced applied technologies. Specifically, this includes the development, dissemination, and demonstration of common and core technologies, pilot testing, etc. In addition to the open sharing of large-scale equipment and facilities in the region, they are responsible for sharing engineering technology centers, corporate technology centers, testing certification centers, key laboratories, etc., promoting regional open sharing services for scientific and technological resources such as research equipment.

(4) Consulting Services

Productivity Promotion Centers undertake consulting services for preliminary work on examining technicians' titles in science and technology-type companies, preliminary review consulting for small and medium-sized enterprises'

²² Torch Plan: A plan for promoting the development of high-tech industries, mainly providing financial support for the construction of high-tech parks, science parks, and resident companies.

²³ Spark Plan: A plan for promoting economic development in rural areas through science and technology, funding projects in agricultural product processing, high-efficiency cultivation, and high-efficiency breeding.

high-tech company applications and high-tech product certification In addition to providing advisory and consulting services on technology, management, policies, and regulations to research and development organizations, the Centers conduct soft science research, offering research and consulting services for policy research, planning, and decision-making. By establishing a standardized expert database, the centers provide one-stop standardized technical consulting to research and development organizations.

(5) Dissemination of Scientific and Technological Achievements

Productivity Promotion Centers conduct activities to exhibit, display, and disseminate scientific and technological achievements, contract technology market promotion services and implement services such as evaluation of scientific and technological achievements, public announcements of results, and disclosure of result information. They take responsibility for integrating and promoting the operations of regional scientific and technological achievement exhibition and trading centers, providing services for scientific and technological events, science popularization, organizing exhibitions and conferences, and facilitating the matching, cooperation, and transformation of scientific and technological achievements.

(6) Other Services

The Centers also provide services such as marketing, investment and financing, loan guarantees, and international cooperation to research and development organizations, along with deduction services for investments in scientific research and test development and for companies' R&D investments. Additionally, they provide guarantee services to promote the transformation of scientific and technological achievements and technology transfer, along with handling the certification, registration, and guidance of related tasks for technology contracts.

(3) Activities

Productivity Promotion Centers are STIAs that focus on fostering emerging industries and supporting the development of science and technology-type enterprises. Based on universities and other research departments, they gather and integrate excellent innovation resources from both domestic and international sources. They also utilize scientific and technological seeds from research organizations as a source of innovation, understand the technological and financial needs of companies, and accurately implement services that bridge universities, research institutions, and companies.

At the same time, they support the development of the regional economy and enhance the innovation capacity of the area where the Center is located. They aim to facilitate the downward movement of scientific and technological achievement transformation services, promote the transformation of scientific and technological achievements, and encourage secondary technological development. To achieve this, Productivity Promotion Centers across various locations actively guide and cooperate with regional centers through the establishment of branches, joint institution formation, signing of cooperation agreements, and provision of remote services.

Currently, there are several models of industry-academia-research collaboration being advanced by universities and other research organizations and Productivity Promotion Centers.

(1) Personnel Training Model

Universities are crucial venues for student training and serve as talent supply bases. The quality and skills of personnel needed by companies are determined by the functions of universities. To smoothly connect the supply chain and demand chain, university students must possess the precise qualities required by companies.

With rapid updates to knowledge in the information age and the changing needs of corporations, Productivity Promotion Centers conduct training focused on skills and knowledge rooted in companies. Specifically, they implement the following:

i. Establishing courses with distinctive characteristics

In addition to regular classes teaching theoretical knowledge, new courses are launched with distinctive features where students enter companies or company representatives to study at universities, providing students with specialized knowledge and training.

ii. Establishing bases for corporate internships and conducting module-based internships

In practical courses, after the theory modules are completed, students go to companies to undertake internships. Companies, while continuing business as usual, arrange on-site training for students, who are supervised and instructed by professional technicians.

iii. Jointly training graduate students and establishing postdoctoral stations

In the case of training graduate students, specialized graduate students are jointly trained by universities and companies. These students are capable of assessing practical issues and conducting academic research based on them. Ph.D. students focus on both research and the transformation of achievements while being based at companies.

(2) Technology Introduction Model

As a bridge between universities and companies, Productivity Promotion Centers actively promote the absorption of the latest results of research organizations into companies through tasks such as bridging the frontlines and intermediary promotion. Specifically, they implement the following:

i . Joint construction of laboratories

Companies use cooperation opportunities to invest in research organizations to build laboratories, utilizing them for research on technical issues, process improvements, and new product development and technological innovation.

ii. Creation of technology incubation bases

Establishing high-tech incubation bases with "in-campus research, off-campus optimization", allowing students to optimize and deepen the key areas of company technologies while learning technology theories, enabling improvements in research levels.

iii. Technology transfer

The results accumulated by research organizations are core competencies needed by companies. Thus, technologies are transferred in the form of patent transfers, aiming to produce mutual benefits.

iv. Commissioned development

Companies contract universities for joint development of specific technologies on a contractual basis, aiming for efficiency in technology development.

These are all feasible operation models that Productivity Promotion Centers have actually engaged in.

(3) Information Service Model

Modern information changes rapidly in a very short time, and universities and other research organizations are compelled to assess societal needs in a timely and accurate manner. Productivity Promotion Centers focus particularly on transforming the scientific and technological achievements needed by companies, combining information on companies' development needs with scientific research and technological development. Specifically, this involves: i. Hosting scientific and technological exhibitions and achievement exhibitions. Productivity Promotion Centers regularly organize themed exhibitions to present scientific research and project outcomes, actively facilitating exchanges between research organizations and companies. ii. Holding industry briefings and exchange meetings. Hosting exchange meetings with industry leaders to exchange and communicate industry information, etc.

(4) Comprehensive Service Model

University faculty members are recruited as information service guidance experts to the Productivity Promotion Center, creating a comprehensive information exchange database. In collaboration with business consortiums, scholarships, and science and technology research and development contests are established for research organizations such as universities.

Productivity Promotion Centers serve as a crucial hub connecting upper-level scientific research organizations with many small and medium-sized enterprises below, acting as an important bridge linking the science and technology chain with the industrial chain and universities with companies. The cooperation model based on Productivity Promotion Centers, involving industry, academia, and research, is entirely new. It aids in resolving communication and exchange issues between universities and companies, deepens cooperation and interaction, enhances the efficiency of collaboration, strengthens the transformation of scientific and technological achievements from universities, and promotes innovation reform in companies.

Through the platform connection and mediation functions of the Productivity Promotion Centers, a research methodology is formed that is professional, meets societal needs, and aligns with societal development demands, producing a certain influence and having clear advantages in society, mainly in the following aspects:

i. Strengthening Industry-Academia-Research Bridging

With economic growth, the number of companies has increased, and demands for information are constantly evolving. Productivity Promotion Centers collect information from companies and seek collaboration with them, acting as hubs for the transition from "one-to-many" to a "one-to-one." Previously, visiting each company through personal routes was the only option, but with so many companies, resource alignment was challenging. Through the coordination of Productivity Promotion Centers, it is possible to accurately and comprehensively collect corporate needs and match them with the current state of scientific research.

Scientific research projects correspond to the production chain of one company or one type of company, allowing researchers to learn and gain experience regarding practical benefits, effectively transforming scientific and technological achievements into economic benefits. Productivity Promotion Centers work to streamline communication between universities and companies, directing research activities in more relevant directions.

ii. Leveling Up Industry-Academia-Research

Development in various fields of industry-academia-research is promoted through the intermediary services of the Productivity Promotion Centers. Company production transforms the accumulation of science and technology from partner universities and research and development institutions into economic benefits, allowing smoother implementation of such processes, reducing the time companies spend solving technical difficulties and improving the efficiency of transforming achievements.

The synergistic effects with the Productivity Promotion Center enable researchers to build a more directed knowledge system, accurately assess the needs of company production sites, and accumulate practical experiences. Productivity Promotion Centers structure research with the goal of fully linking research outcomes with economic benefits. This makes the close integration and mutual penetration of the triangle between industry-academia-research through the mediation of Productivity Promotion Centers critically important in reality.

iii. Enhancing Job Matching Advantages

Research organizations centered around universities, using Productivity Promotion Centers as a base, create bridges with companies through information transmission, clearly assessing their personnel needs while analyzing the professional qualifications and technical hardware knowledge these individuals should possess based on those needs, serving as a basis for student career guidance. Also, using recruitment information and company trends provided by the Productivity Promotion Centers, these organizations assess the employment situation in the industry, aim to produce changes in consciousness, and improve student's skills according to company technical requirements, enabling them to become "knowledgeable of oneself and the opponent, undefeated in battle."

2.1.3 Technology Achievement Transformation Centers (科技成果转化促进中心)

(1) Overview

Technology Achievement Transformation Centers are a business organization belonging to the government's science and technology management departments, mainly responsible for policy formulation related to science and technology intermediary services and the comprehensive functioning of the government for the industrialization of scientific and technological achievements. The name of these centers varies by region, with the Ministry of Science and Technology's Torch Center, provincial and municipal departments, universities, and other research and development organizations commonly referring to them as "Technology Achievement Transformation Centers".

In recent years, in response to new changes surrounding transforming scientific and technological achievements, systematic one-stop comprehensive science and technology innovation service systems have been established as private entities, performing science and technological achievement transformation services on behalf of the government under the name of Technology Achievement Transformation Centers. Serving as a platform for market-driven science and technology transfer promotion services, the Centers help ensure the economic viability of projects, facilitating smooth commercialization and forming market-oriented business models, thereby offering services that promote the transformation of scientific and technological achievements.

Furthermore, there are some conceptual differences between the Technology Achievement Transformation Centers and technology transfer organizations (Note: "technology transfer organizations" refer to one of the science and technology intermediary organizations promoting technology transfer for social implementation. However, they are not included among the eight institutions targeted in this report). Specifically, the transformation of scientific and technological achievements is focused on change, that is, changes in scientific and technological achievements or technology forms. On the other hand, technology transfer emphasizes "transfer," that is, changes in the spatial location of technology. The transformation of scientific and technological achievements refers to converting cuttingedge science and technology into productive forces, that is, from theoretical strategies to actual use, while technology transfer refers to transferring technology to other institutions for application.

The transformation of scientific and technological achievements refers to the process of taking results from research and technology development that have practical value and, aiming to improve productivity, continuing with testing, development, application, and dissemination to create new products, processes, and materials, thereby contributing to the development of new industries. Technology transfer refers to the process where a certain technology (mature technology or technology where invention has occurred) is transferred and applied from its original location or field to another place or field.

(2) Focus on Industrialization of High-Tech

Referring to the specific tasks of the Ministry of Science and Technology's Torch Center and the achievement

transformation centers under local government science and technology departments, <u>the general responsibility of</u> <u>a Technology Achievement Transformation Center</u> is to promote technology innovation and transformation for high-tech industrialization and other purposes through a series of policy measures including high-tech industrial development zones, incubators (including group innovation spaces²⁴), high-tech companies, technology markets, science and technology finance, innovation industry clusters, science and technology-type small and medium-sized enterprises. Through these measures, they contribute to the industrialization of high-tech sectors by promoting technological innovation and transformation, strengthening the integration of science, technology, and the economy, adjusting industrial structures, and enhancing the innovation capacity of regions.

Their specific functions include:

- 1. Conducting research on the current situation, trends, and key issues related to high-tech industrialization, high-tech industrial development zones, high-tech companies, and the environment for scientific and technological innovation and entrepreneurship, implementing related statistics, monitoring, evaluation, and making policy recommendations for macro-level decision-making by departments with jurisdiction over science and technology. Promoting the commercialization, industrialization, and internationalization of high-tech achievements.
- 2. Conducting policy research, management guidance, and consulting services for high-tech industrial development zones. Undertaking related activities for independent innovation demonstration zones.
- 3. Promoting open sharing services for scientific and technological resources, such as sharing research equipment between regions. Implementing service activities for docking and transformation of scientific and technological achievements, exhibition and dissemination of technological achievements, organizing science and technology events, science popularization, exhibitions and conferences, and cooperation and transformation of scientific and technological achievements. Implementing the construction, operation, and maintenance of platforms for the transformation of scientific and technological achievements.
- 4. Undertaking research and implementation activities to promote the development of science and technologytype small and medium-sized enterprises. Conducting evaluations of science and technology-type small and medium-sized enterprises and promoting the construction of information service platforms for them. Taking on special projects to support technology innovation by science and technology-type small and medium-sized enterprises.
- 5. Bearing responsibility for the implementation of policies related to the transformation of scientific and technological achievements, implementing plans, schemes, and policies to promote the transformation and industrialization of scientific and technological achievements.
- 6. Assisting with registration of scientific and technological achievements (Ministry of Science and Technology), registration of technology contracts, deduction of companies' research and development expenses, and other related management tasks.
- 7. Providing specific management of entrepreneurship incubation carriers such as incubators, group innovation

²⁴ Group Innovation Spaces ("衆創空間") are a new type of incubator, where "crowds" are the subject, "creation" is the content, and "space" is the carrier. They are a response to the trends of user innovation, open innovation, collaborative innovation, and mass innovation, capturing the opportunity of the rise of global creators, constructed under the development of the Internet and its applications, through market-based mechanisms, professional services, etc., providing a new type of convenient and low-cost service for entrepreneurship.
spaces, university science and technology parks²⁵, etc. Constructing and operating data resource centers for innovation and entrepreneurship. Organizing empirical scientific and technological innovation and entrepreneurship activities and guiding the development of technology transfer talent teams.

8. It researches and proposes investment and financing policy measures to promote the development of technological industrialization and guides social capital to support the development of science and technology-type enterprises. It also promotes the implementation of roadmap plans for the growth of science and technology-type small and medium-sized enterprises.

(3) Promotion of Regional Innovation and the Transformation of Achievements

Technology Achievement Transformation Centers are organizations responsible for the policy formulation and implementation of intermediary services. They also utilize hardware and software resources from shared platforms, such as hardware at public facilities, and promote the transformation of scientific and technological achievements. The centers provide convenient soft and hard conditions for research and development, consulting and evaluation, and the practical application of achievements in the process of transforming scientific and technological outcomes. They have also served as a model for transformation activities. They represent a uniquely Chinese government-led transformation of science and technology achievements, where the market and planning are integrated, and their effectiveness has been proven in practice.

For example, in recent years, various centers have shared state-owned large-scale equipment platforms, equipped the platforms with shared large experimental and analytical instruments and devices, and provided analysis and testing services, making it easier for outside entrepreneurs to conduct standard tests and research. This has increased the efficiency of resource utilization for equipment and facilities, avoided duplication and waste in equipment acquisition, and efficiently advanced regional scientific and technological innovation and the transformation of scientific and technological achievements while ensuring equipment is kept up to date.

(4) Contributing to the Discernment of Technology

In China, <u>most of the cutting-edge scientific and technological achievements are produced by universities and</u> research and development institutions. Issues surrounding research outcomes not meeting market demands and having low transformation value mainly apply to public research and development institutions. This situation necessitates strong government management for adjusting and guiding research resources. Meanwhile, <u>most</u> companies lack relevant talent and the ability to identify relevant technology. They are unable to assess development trends or the direction of industrial policies, thus requiring government guidance in policies and demonstration projects.

The Technology Achievement Transformation Centers were established to meet these needs. <u>With the</u> <u>involvement of these Centers, powerful measures such as the provision of environmental conditions conducive to the</u> transformation of achievements, acceleration of the transformation speed, and creation of scale advantages can be

²⁵ University Science and Technology Parks: National University Science and Technology Park is a science and technology entrepreneurship service organization jointly approved and accredited by the Ministry of Science and Technology and the Ministry of Education. It serves as an incubator, acting as a source of innovation for the development of the regional economy and the technological advancement of industries, and is also an important platform for universities to realize the integration of industry, academia, and research, as well as their social service functions.

quickly established. As the reform of the scientific and technological system progresses, private institutions similar to the government version of the Technology Achievement Transformation Centers are steadily increasing, improving the insufficiencies of these Centers at the market level and producing a situation where government and private institutions cooperate to build a comprehensive service platform.

(5) Activities

(1) Intermediaries break the "sponsorship relationship"

Unlike the industry-academia-government model implemented in Japan and Western countries, China has a combination of government-industry-academia-research, which is suitable for advancing the transformation of scientific and technological achievements in accordance with China's national conditions.

For many years, the relationship between companies and universities has been one of sponsorship, where companies provide funding to university researchers, and universities solve specific problems for companies. This situation meant intermediary organizations providing services to companies and universities or research and development institutions have not been able to exert sufficient power. The integration between universities and their local regions is not deep, and a healthy reciprocal relationship has not been established between the research directions of university departments and the promotion of regional economic development.

In terms of social awareness, the policy demands of universities are focused on information dissemination platforms and the construction of University Science and Technology Parks. In terms of demands for research and development funds, while universities make policy demands, research and development teams that become corporatized also make many policy demands. In terms of social recognition, the policy demands of universities are focused on information dissemination platforms and the construction of University Science and Technology Parks. In terms of capital, universities' policy demands related to the capital are focused on information dissemination platforms, intermediary service systems, and pre-evaluation and screening mechanisms.

(2) A government-led industry-academia-research promotion mechanism is established

Against this background, based on the original industry-academia-research model, the government-industryacademia-research model was launched to have the government play a more active role, with the Technology Achievement Transformation Centers at the core, acting as "matchmakers" between universities and research and development institutions, effectively advancing the deep integration of districts and universities, and expanding "bridging." Additionally, companies with certain capabilities are encouraged to establish research and development centers, utilize regional resources, and employ young students. Additionally, companies with real capabilities are encouraged to establish research and development centers, utilize regional resources, and employ young students.

Currently, Technology Achievement Transformation Centers under the jurisdiction of local governments are adopting the following policies to promote the scientific and technological progress of companies and strengthen the pace at which scientific research achievements from research and development institutions and universities are brought to market: (1) Building information dissemination network platforms for industry-academia-research, (2) Establishing pre-evaluation and screening mechanisms, (3) Promoting the construction of University Science and Technology Parks, (4) Improving the benefit distribution mechanism of industry-academia-research cooperation, (5) Building a sound intermediary service system - among others. Under the policy-driven and practice-driven approach of the Technology Achievement Transformation Centers, a government-led industry-academia-research promotion mechanism suited to China's national conditions and regional characteristics has been fundamentally established in

various regions.

2.1.4 Technology Property Right Exchange Organizations

(1) Overview

There are no unified national regulations for the management of Technology Property Right Exchange Organizations. According to the property rights transactions and technology contract accreditation management regulations in various locations such as Beijing and Jiangsu Province, a Technology Property Right Exchange Organization refers to an independent legal entity that mainly performs specialized services such as technology evaluation, technology transfer, and science and technology consulting for the transformation of scientific and technological achievements.

The main operations of the Technology Property Right Exchange Organizations are as follows: (1) Providing centralized exchanges for technology transactions and constructing a Chinese transaction information service platform, (2) Collecting, selecting, analyzing, processing, and publishing technology information, (3) Aggregating transactions, technology transfer, and technology representation, (4) Technology integration and secondary development, technology dissemination, (5) Technology consulting, technology evaluation, technology training, technology bidding services, technology investment and financing, and other activities related to the promotion of technology transactions, (6) Transaction supervision (meaning that the Technology Property Right Exchange Organizations effectively supervise and manage transaction parties and members, ensuring that technology property rights trading activities comply with laws, regulations, and the transaction principles stipulated in transaction regulations), (7) Certification (after the transaction of technology property rights, the Technology Property Right Exchange Organizations certify that technology property rights transactions comply with laws, regulations, and issue certifying documents to both transaction parties), (8) Management of entrustment of shares (with government approval, Technology Property Right Exchange Organizations can be entrusted with the management of shareholder registers from unlisted companies, and can perform change registration and pledge registration according to valid legal documents).

Technology Property Right Exchange Organizations generally adopt a membership system and a consignment agency system. After a project is opened, the trading organization conducts related document reception or delivery and related procedures through member agents. At the same time, the trading organization provides services to member organizations and both sides of the transaction, including (1) recommending the opening of businesses, (2) recruiting, selecting, and recommending transaction projects, (3) designing and implementing varieties of transactions, (4) establishing transaction conditions according to the characteristics of transaction varieties, (5) providing negotiation and trading venues for both sides of the transaction, (6) coordinating transaction activities between both sides of the transaction and intermediary agencies, (7) providing transaction, settlement, and delivery services, (8) issuing transaction documents, (9) and other services required in the course of transactions.

<u>Technology Property Right Exchange Organizations have the right to supervise and inspect the trading activities</u> of startup projects and impose penalties for violations of laws and regulations based on transaction rules. Deposits may be requested from transaction parties or related parties depending on the actual necessity of ensuring the safety of transactions.

Technology Property Right Exchange Organizations can mediate disputes related to contract breaches between

transaction parties upon request. If mediation fails, the transaction parties can initiate civil litigation or apply for arbitration according to the law.

(2) Contributing to Technology Transfer and Conversion

After years of development, Technology Property Right Exchange Organizations are actively contributing to technology transfer and transformation services. Firstly, they act as demonstration leaders for technology transfers. By focusing on the effective technology needs of enterprises through the trading organization, building close relationships with enterprises, universities, and research and development institutions, and leading cooperation and matching between the supply and demand sides, they play an active role as promoters and leaders in constructing the science and technology innovation system.

They also play a role in expanding the network of technology transfer. Each trading organization builds various technology transfer networks that cover local and surrounding areas and connect to the country as a whole. These networks include innovation stations, technology transfer hubs, and international technology transfer partnerships. The organizations also play a role in improving the capability of transfer services. They provide enterprise-oriented technology transfer and technology transaction services using technology project information collection and checking, project matching and promotion meetings, technology intermediation, technology holding/selling, technology consulting, and technology evaluation.

(3) Activities

(1) Supporting the transfer of achievements from research and development institutions

The chain of transformation of scientific and technological achievements is long, involving many players in various scenarios of industry-university-research cooperation, especially with the potential emergence of diverse types of investment players. A good intellectual property environment and clear definition and protection of property rights are important prerequisites for successfully converting scientific and technological achievements, and also serve as the basic guarantee and starting point for organic interaction between industry, academia, and research.

The Law of the People's Republic of China on Promoting the Conversion of Scientific and Technological Achievements stipulates that the price of scientific and technological achievements held by universities and research and development institutions can be determined through listing and trading on the technology exchange market or through auction, laying the foundation for the standardization of the future commercialization and capitalization of scientific and technological achievements, and the distribution of income from subsequent transformations.

Technology Property Right Exchange Organizations, leveraging their platform advantages, identify fair market prices, support research organizations such as universities in efficiently completing patent technology transfers, and lay a solid foundation for the industrialization of subsequent scientific and technological achievements. At the same time, they ensure that the transformation of achievements is conducted legally and in compliance through floor trading methods.

Many research and development institutions, including the Chinese Academy of Sciences, belong to business organizations, and in the process of transferring scientific and technological achievements, particularly in transferring the ownership of state-owned assets, many problems arise surrounding their disposal. It is, therefore, necessary to act in accordance with relevant domestic regulations, as slight negligence can easily raise questions about the loss of these assets or inadequate supervision. Therefore, both researchers and research institute leaders must be cautious in

asset management related to the transformation of scientific and technological achievements. However, being overly cautious can inhibit the transformation of scientific and technological achievements. Issues related to ownership transfer, etc., are addressed by choosing to list on the Technology Property Right Exchange Organizations and ensuring the fairness and rationality of transactions based on fair market prices, thus achieving legal compliance in the transformation process.

(2) Challenges surrounding smooth transfers

Currently, China's reform of the transformation of scientific and technological achievements is entering a more complex phase. Issues such as "whether there is the right to transfer" and "whether there is the will to transfer" are no longer obstacles. Instead, "whether there is a transfer" and "whether the transfer goes smoothly" have become new challenges. The transformation of scientific and technological achievements will be increasingly necessary in the future to ensure that the market plays a decisive role in the allocation of resources, actively breaks through the practical bottlenecks in the synergistic effect of technology and market innovation and achieves the goal of elevating the level of China's science and technology innovation.

Technology Property Right Exchange Organizations are also engaging with enterprises to explore technology needs and promote the transfer and transformation of technological achievements. By participating in various technology transfer activities such as provincial and municipal science and technology competitions, patent auctions, innovation competitions, and dissemination meetings for various achievements, and through expert company visits and cooperation with industry alliances, the organizations collect the various needs of enterprises and publish related needs and the results of scientific and technological transformations both online and offline in a timely manner.

Going forward, Technology Property Right Exchange Organizations at all levels need to integrate existing services such as technology transactions, price setting, and the transformation of scientific and technological achievements, realize the comprehensive integration of technological factors in terms of achievement registration, price setting, and transactions, science and technology services, financial products, and capital matching, and enhance and improve functions useful for intellectual property transactions and operations, further contributing to China's technological innovation.

2.1.5 Science and Technology Financial Service Organizations ("科技金融服务机构")

(1) Overview

Broadly interpreted, Science and Technology Financial Service Organizations include all financial institutions that provide financial services at every stage of development (startup, growth, maturity, decline, and exit) of science and technology-type companies. Venture capital that primarily provides financial support during the founding phase is included as part of Science and Technology Financial Service Organizations.

Currently, most Science and Technology Financial Service Organizations are government-led, with venture capital playing a supplemental role within these government-affiliated Organizations, which operate within the bounds allowed by government guidance. Venture capital is not a Science and Technology Financial Service Organization specialized in high-tech industries.

On October 25, 2022, the Ministry of Science and Technology published the 14th Five-Year Plan for the Special Plan of the Technology Factor Market ("'十四五'技术要素市场专项规划"). The plan explores mechanisms to link technology transactions and the capital market, clearly stating that financial investments play a role in the

evaluation of scientific and technological achievements. It actively considers the use of comprehensive post-operation support, guidance funds²⁶, risk compensation, science and technology insurance, loan discounts, etc., to support the transformation of achievements.

In November 2021, the "Interim Measures for the Management of the National Guiding Fund for the Conversion of Scientific and Technological Achievements" ("国家科技成果转化引导基金管理暂行办法") were published. They state the funds are to be primarily used to support the transformation of scientific and technological achievements. The measures also state that methods of support by the transformation fund include the establishment of venture capital sub-funds, loan risk compensation, performance incentives, etc. The Measures also adjust the evaluation indicator system of sub-funds of the National Guiding Fund for the Conversion of Scientific and Technological Achievements, guiding investment institutions to make early and small-scale investments and strengthening support for seed stage and startup science and technology-type companies. They encourage the search for an investment + incubation model, where innovation and entrepreneurial carriers establish angel investment funds. They also mention considerations regarding differentiated financial support for different stages of scientific and technological achievements, such as concept validation, pilot testing, and industrialization.

The content of the Measures comprehensively stipulates the funding sources, role, investment direction, methods of support (establishment of venture capital sub-funds, loan risk compensation, performance incentives, etc.), exit, risk management, and sub-fund management of the Guiding Fund. The content also provides orderly guidance for the expansion of investments by social forces and local governments in the transformation of scientific and technological achievements.

The government's guidance fund focuses on the transformation of scientific and technological achievements as a method to attract social capital investments. While government guidance funds focus on long-term research and development innovation, social capital plays a significant role in transforming scientific and technological achievements into commercial value. Government guidance funds deploy and implement scientific and technological achievements early and establish new sub-funds, whereas social capital promotes diversification of capital investments through the realization of social and commercial value, achieving industrial development through the transformation of scientific and technological achievements.

<u>Government-led science and technology financial services</u> are mainly <u>conducted in the form of various funds</u>, such as science and technology public interest funds, science and technology private placement funds, major innovation platform science and technology innovation funds, and science and technology innovation funds. <u>Social capital</u> <u>financial services institutions are mainly classified into two categories</u>. <u>One is policy funds organized by financial</u> <u>investment institutions and financial intermediaries (including guarantee institutions, insurance institutions,</u> <u>investment institutions, etc.</u>), mainly investing in strategic, influential major science and technology innovation projects and early-stage major innovation projects, leading the development of various science and technology innovation funds. <u>The other is private institution-led science and technology investment and financing platforms</u>. These platforms, such as entrepreneurial cafes and industrial parks, combine various entrepreneurial support services for entrepreneurs, including financial investment and financing functions for innovation creation.

²⁶ Guidance Funds: Also called a venture capital fund, guidance funds are a special fund financed by the government that attract relevant local governments, financial and investment institutions, and social capital to invest in venture capital institutions and new venture capital funds in the form of equity or bonds, without a profit motive, to support venture company development.

(2) Establishment of a Diverse Financing System

The development of Science and Technology Financial Service Organizations helps to build a good science and technology financial services system for the transformation of scientific and technological achievements and provides means for credit supplementation and risk mitigation for the transformation of achievements. Science and Technology Financial Service Organizations, which are composed of government and social capital, support the science and technology financial services system in the entire process of growth by science and technology innovation companies.

Financial support products are designed to cover the entire cycle of the supply chain. They include technology achievement loans and science and technology creator loans suitable for science and technology-type companies in the early stages of growth, credit loans, and science and technology dividend rights-attached loans applicable to "small giant companies"²⁷ that are in the development stage as science and technology-type companies, as well as loans for companies planning to list on the STAR market. Currently, the financing needed from the initial scientific research activities to the process of transforming scientific and technological achievements has shifted from traditional bank lending to a diverse financing system utilizing funds, bonds, stock markets, venture capital, and internet finance.

High-tech research and development, application, and high-risk, high-tech innovation are fundamentally supported by financial services institutions like venture capital, with mechanisms pre-constructed to compensate and encourage financial risks in science and technology. Relatively mature, large-scale science and technology innovation projects or companies are mainly supported by lending models based on commercial bank credit, complemented by other financial products.

(3) Activities

(1) Science and Technology Finance Promoting the Development of Industry-Academia-Research

The transformation of scientific and technological achievements is a systematic process under national leadership, supported by policies, driven by market needs, and facilitated by science and technology finance, promoting the orderly development of industry-academia-research collaboration. Science and Technology Financial Service Organizations play the role of service providers in the industry-academia-research system, acting as accelerators. The integration of industry, academia, and research focuses on how to acquire more capital and how to sustain financial capital support. Financial intervention allows industry-academia-research collaboration projects to proceed smoothly until success.

Firstly, financial services institutions diversify investments with substantial capital, investing in successful projects and adjusting ineffective projects, building a sustainable model that enhances overall profitability and tolerance for failure. This is a solution to the problem that modern technology innovation and the industrialization of achievements from industry-academia-research cooperation not only require substantial investments but also involve high risks.

Next, with the advancement of modern science and technology and the improvement of productivity, the division of labor in society has become more subdivided, and the fields of science and technology innovation and the transformation of achievements have also become more segmented. The advantage of specialized financial services institutions lies in constructing relatively sound products, technologies, services, and risk management models,

²⁷ Small Giant Companies: Refers to small-scale companies with good performance, high development potential, and incubation value in the early stages of growth.

reducing investment decision risks, and realizing capital appreciation.

Lastly, in the integration of industry, academia, and research for innovation and transformation of scientific and technological achievements, it is necessary to coordinate the interests of all entities and build an incentive-rich profit distribution model. In cases where industry, academia, and research institutions are the main players, there is often a need to focus on technological innovation, and there may be issues with capital operations and management due to different fields having entirely different practices. Specialized financial service organizations for science and technology can provide financial management consulting and other specialized services to the main bodies of innovation and undoubtedly provide vital support for the entire flow of innovation.

The requests in the Ministry of Science and Technology's 2021 "Letter from the Ministry of Science and Technology on Supporting the Construction of National Science and Technology Achievements Transfer and Transformation Demonstration Zones in Wuhan, Xiangyang, and Yichang Cities in Hubei Province" ("科技部关于 支持湖北省建设汉襄宜国家科技成果转移转化示范区的函") specifically outlined the concept and goal of actively building a technology transfer ecosystem with a combination of "politics, industry, academia, research, finance, intermediaries, and usage" ("政・産・学・研・金・介・用") acting as the main carriers of high-tech parks for the first time. Furthermore, by 2025, it proposed establishing new demonstration bases for industry-academia-research cooperation as hubs and focal points for the innovation and implementation of national policies on the transfer and transformation of scientific and technological achievements, aiming to make them nationally significant terminal technology markets.

Based on the letter, the People's Government of Hubei Province established an innovation promotion team led by Governor Xiaodong Wang to oversee and manage this proposal. As of March 2023, tasks such as the construction of the scientific and technological achievements evaluation system, construction of national key laboratories, and construction of scientific and technological achievements databases included in the national science and technology achievements transfer and transformation demonstration zone construction plan were almost completed. The fiscal year of 2023 (January-December 2023) plans to focus on reforms of the financial system in the transformation of scientific and technological achievements.

(2) New business models alleviate financial pressure

Science and Technology Financial Service Organizations play a vital role as part of a new concept, not only providing monetary support but also including intermediary services. Currently, these organizations mainly act as bridges in finance, gathering resources from policies, industries, universities, research and development institutions, and applications based on government policy support and using technology research and development as a driving force, integrating resources from upstream and downstream in the industrial chain, innovating business and financial models, and constructing a "seven-in-one" project promotion model of "politics, industry, academia, research, finance, intermediaries, and usage" to achieve cross-industry integration and solutions and to jointly seek high-level developments in the transformation of scientific and technological achievements.

First, Science and Technology Financial Service Organizations organize financial and industrial experts to design business models for industry-academia-research cooperation, plan for the development of science, technology, and industry, and provide investment and financing services. The new business models devised by these organizations have alleviated financial pressures on enterprises and governments, enhancing motivation among universities and research organizations. Next, once a market is determined by the business model, the organizations can guide academia and research, directing research, development and production. Finally, even after solving the core technologies for academia and research, follow-up from industry is needed.

Science and Technology Financial Service Organizations, local governments, and enterprises have established industry funds to support clearly targeted research and development and production by industry-academia-research collaborations, thus promoting rapid and high-quality development in the transformation of scientific and technological achievements.

2.1.6 Patent Agencies ("专利代理机构")

(1) Overview

According to the <u>Patent Law of the People's Republic of China</u> ("中华人民共和国专利法"), <u>Patent Agency</u> <u>Regulations</u> ("专利代理条例"), and <u>Patent Agency Management Measures</u> ("专利代理管理办法"), <u>Patent Agencies</u> <u>are entrusted to handle patent applications, invalidation of patent rights, transfer of patent application rights or</u> <u>patent rights, patent implementation licensing contracts, and other patent affairs, and can provide consulting on</u> <u>patent matters upon request.</u>

Patent Agencies can be established as partnerships or limited liability entities but require that all partners or at least four-fifths of shareholders are qualified patent agents with at least two years of practical experience as a patent agent. To qualify as a patent agent, one must pass the patent agent examination hosted annually by the National Intellectual Property Administration. The pass rate is around 10% each year, and after passing the examination in three subjects - patent law, general legal knowledge, and patent agent practice - one must complete a one-year internship at a Patent Agency before obtaining the patent agent qualification.

The National Intellectual Property Administration supports and guides Patent Agencies in providing support services to micro-enterprises, inventors, and designers with no income or low income through policy formulation and system construction measures. It also encourages Patent Agencies to utilize their resources to provide patent agency support services.

(2) Contributing to the Transformation of Achievements through Patents

Patent Agencies mainly promote consulting on research activities and scientific and technological achievements and the transformation of scientific and technological achievements in the following aspects:

- Participation in the collection of scientific and technological achievements through patent information search and analysis services. When specific technology needs or specific technology themes need to be targeted, patent information search and analysis is undoubtedly an effective means to reduce the cost of results collection.
- 2. Participation in the evaluation and selection of scientific and technological achievements through patent value evaluation services. In evaluation and selection, technical value, economic value, and implementation risk are assessed, and technologies that have already been patented are evaluated from the perspective of legal value, providing plentiful opportunities for organizations offering intellectual property services to be involved.
- 3. Protecting scientific and technological achievements comprehensively through patent application layout services. Undoubtedly, patent applications are an important means to protect scientific and technological achievements. It is particularly vital to prepare the layout of patent applications before trying to reveal the appeal of scientific and technological achievements to the market.

4. Participation in the incubation of science and technology startup projects through intellectual property investment and financing services. For entrepreneur teams transforming scientific and technological achievements on their own, the entire process of industrialization, especially the large-scale production stage and bringing-to-market stage, always involves financial pressure. The core assets of the startup team are undoubtedly patents, and patent-secured financing becomes an important means of funding for startup companies.

(3) Contributing to Patent Protection Strategies for Researchers

In promoting research and development activities and aiming for the transformation of scientific and technological achievements, many research organizations face problems surrounding achievements being difficult to transform, not reaching the stage of transformation, choosing not to transform them, and being unable to transform them. The involvement and support of specialized Patent Agencies can be very effective in solving these problems.

Being difficult to transform mainly refers to the protection of intellectual property rights of innovation achievements not reaching a certain standard. Many issues that hinder the transformation of innovation achievements are not related to the scientific and technological quality or commercial application value of the innovation achievements themselves, but the low quality of the intellectual property rights associated with the innovation achievements. Researchers lack the necessary awareness of patent protection and basic patent protection strategies when conducting research or innovation. Through patent strategy and protection mechanisms provided by Patent Agencies, it's possible to discover the commercial value of patents from an industrial perspective and provide maximum legal protection for patent rights.

Not reaching the stage of transformation is due to the lack of market competitiveness of scientific and technological achievements. Insufficient utilization of patent information in the innovation process and insufficient integration with industrial development make the innovation process of scientific and technological achievements inefficient, and many studies have problems with duplication. Through long-term support from professional personnel in the patent service industry, it is possible to form a valuable patent portfolio that meets the competitive needs of the market.

Many reasons for "daring not to transform" are due to unclear attribution of property rights amongst scientific and technological innovation achievements. Clear property rights lay the foundation for increasing the market transformation efficiency of innovation achievements. Over the years, research and development funds for universities and research institutions have been supported by multiple sources and methods, and it is easy for inventions and creations by staff of universities and research institutions to be considered as inventions on duty, with their intellectual property rights owned by the organization. Furthermore, some significant innovation achievements often result from large-scale joint research or efforts spanning generations, with intellectual property rights extending to multiple joint research organizations and cooperative teams. Transferring for profit purposes can easily lead to disputes over the attribution of patents. Some who have created inventions as part of their job duties may not wish to transform them. Through analysis and adjustment of patent rights, it's possible to coordinate the attribution of rights and cooperative relationships for scientific and technological achievements, solving potential contradictions and risks from their root cause.

Being unable to transform results is because universities and other research organizations lack the specialized ability to put the results of scientific and technological innovation into operation. The implementation of China's science and technology plans often spans various departments and organizational project teams, meaning they lack

a central responsible entity for intellectual property rights. In reality, most researchers conduct their own innovation achievement transformation activities, but even if they are in a profession with good income and benefits, it's often impossible to bring innovation to market. Most existing technology transfer departments in universities and other research organizations only play a coordinating role. Motivation amongst staff is reduced due to insufficient incentive and evaluation mechanisms for intellectual property management and operation experts. By introducing specialized external expertise, it's possible to further enhance the transformation efficiency of research achievements and the overall capability of research organizations in transforming achievements without destroying the original internal mechanisms, respecting the autonomy of research staff, and leveraging the enthusiasm and operational capability of the transformation department.

(4) Activities

(1) Small and medium-sized enterprises with low awareness of intellectual property rights

Industry-academia-research collaboration refers to a systematic process in which companies, universities, and research and development institutions cooperate across disciplines, possessing very strong complementation among different members. When collaborating, both researchers who develop new technologies and companies that commercialize technology and realize the transformation of new technologies into market value are required. Disputes over the ownership of intellectual property rights in the process of cooperation are directly related to the economic interests of each party and directly affect the success or failure of cooperation, so the ownership of intellectual property rights in cooperation must be clarified.

In the process of industry-academia-research collaboration, universities and research and development institutions emphasize the research and development of new technologies, while companies focus on the industrialization of new technologies. When researchers at universities and research and development institutions acquire new technology, their first thought is to publish papers, resulting in a significant loss of intellectual property rights for universities and research and development institutions. Most small and medium-sized enterprises lack research and development capabilities, do not have their own research and development capabilities, and naturally have challenges acquiring core technologies. Even if new technologies are acquired through industry-academia-research collaboration, many companies are still groping in the dark regarding the protection and utilization of intellectual property rights. However, companies' primary concern is the commercialization of new technologies, and because the significance of the intellectual property rights system is not understood, and there is low awareness of using intellectual property rights to protect interests and secure the market, new technologies and products are not protected by intellectual property rights. In addition, cooperation produces many research and development results but few intellectual property rights, so there is room to strengthen the protection and utilization of intellectual property rights.

However, dominating the market through patents is an extremely specialized and complex process, which includes not only early warning of patents and mining of high-value patents but also strategic positioning of patent clusters, formation of patent pools, and patent alliances from the perspective of strategic deployment. Efforts regarding operational aspects such as patent transactions, transformation/application, and international transactions are required to enhance the market value of patents.

(2) Enhancing the value of intellectual property rights through industry-academia-research collaboration

According to the China Technology Market Association's Industrial Convergence Development Committee, recent practical investigations have revealed that intellectual property departments and organizations involved in industry-

academia-research collaboration, such as in Beijing, are exploring an industry-academia-research + intellectual property rights collaboration model to solve the above-mentioned problems. The involvement of intellectual property rights service organizations, such as patent agencies, can deepen the economic value of intellectual property rights within the framework of industry-academia-research collaboration. In particular, it can enrich the economic benefits of intellectual property rights for small and medium-sized enterprises with few assets of their own and solve current practical problems in industry-academia-research collaboration regarding intellectual property rights, such as the shortage of intellectual property rights experts, the homogeneity in forms of cooperation, the difficulty in discovering valuable patents, and the difficulty of maintaining patent rights.

Patent agencies provide personnel, patent technology analysis, patent education, and corporate patent forecasts. They organize experts to conduct industrial analysis of specific industries related to industry-academia-research collaboration, support companies in assessing their own advantages, establish their own intellectual property rights strategies, and achieve deep integration of industry-academia-research and intellectual property rights. Industry-academia-research collaboration is, in fact, a process of creation, operation, transfer, and bringing-to-market of intellectual property rights. Therefore, establishing an industry-academia-research + intellectual property collaboration model and involving institutions that can operate intellectual property rights, such as patent agency services, in industry-academia-research collaboration can greatly promote small and medium-sized enterprises to have their own intellectual property rights, famous brands, and core competitiveness, and provide a reference to solve many problems existing in industry-academia-research collaboration.

2.1.7 Science and Technology Evaluation Organizations (科技评估机构)

(1) Overview

According to the Interim Measures for the Management of Science and Technology Evaluation ("科技评估管理暂行 办法") published and implemented by the Ministry of Science and Technology in December 2000 and the Regulations on Science and Technology Evaluation Activities (Trial) ("科技评估工作规定") published and implemented in December 2016, science and technology evaluations refer to evaluations conducted by Science And Technology Evaluation Organizations for a clear purpose, following certain principles, procedures, and criteria, on science and technology policies, plans, projects, achievements, development fields, institutions²⁸, personnel, and activities.

Through the management process of science and technology activities, their evaluations are generally classified into four types: **preliminary evaluation, ongoing evaluation, post-evaluation, and follow-up evaluation.** Preliminary evaluation assesses the necessity and feasibility of science and technology activities before their implementation. Ongoing evaluation assesses whether science and technology activities are being implemented as intended or according to plan and how they will develop in the future during their implementation. The purpose of evaluation is to identify problems and adjust or correct goals and strategies. Post-evaluation assesses the degree of achievement of the objectives of science and technology activities, and the level, effectiveness, and impact of activities after their completion. Follow-up evaluation is a post-evaluation conducted after a certain period has elapsed since completion,

²⁸ "Science and technology institutions" ("科技机构") refer to organizations that are not enterprises, aimed at providing scientific research and technological services of a certain scale that have fixed facilities and personnel and meeting certain conditions.

focusing on evaluating the overall effectiveness of science and technology activities and the comprehensive impact and experience of policy implementation, goal setting, and program management, serving as a reference for decisionmaking in later stages of science and technology activities.

According to these measures, the subjects and scope of science and technology evaluation include: (1) Research, formulation, and effectiveness of science and technology policies; (2) Implementation status and performance of science and technology plans; (3) Preliminary setup, mid-term implementation, and post-effects of science and technology projects; (4) Comprehensive strength and performance of science and technology institutions; (5) Technical level and economic effect of science and technology achievements; (6) Technological advancement and performance of regions or industries; (7) Science and technology investment behaviors and performance of enterprises and other social organizations; (8) Science and technology personnel; (9) Other science and technology activities.

(2) Promoting the Standardization and Specialization of the Transformation Process

Through science and technology evaluation, standardization and specialization in all aspects of the transformation process of scientific and technological achievements have been promoted to establish enforceable operational standards for independent innovation in China. Specifically, (1) in evaluating science and technology policies, accurately judging the effectiveness of policy implementation and serving as a foundation for formulating and revising science and technology policies; (2) in evaluating science and technology programs, helping to accurately judge the effectiveness of program implementation, and, as a result, serving as a basis for the establishment, optimization, and integration of programs; (3) in the preliminary evaluation of science and technology projects, assisting in accurately judging the prospects and feasibility of projects, serving as a basis for scientific decision-making in project initiation. Ongoing evaluation of science and technology projects helps to accurately assess the progress of projects and serve as a basis for subsequent adjustments; (4) in evaluating science and technology achievements, aiding in accurately judging the level and value of achievements, which can serve as a basis for encouraging and transforming achievements; (5) in evaluating science and technology fields, helping to accurately assess the trends of science and technology development and the specific situation, serving as a basis for deciding when to act or not act; (6) in evaluating science and technology institutions, accurately judging the effectiveness of their activities, serving as a basis for the establishment, integration, and adjustment of science and technology institutions; (7) in evaluating science and technology personnel, helping to accurately judge the contributions of these personnel and their extent, serving as a basis for title reviews and encouragement; (8) in evaluating actions related to science and technology activities, being able to accurately judge the impact and effectiveness of science and technology in relation to other activities, serving as a basis for coordinating the relationship between science and technology activities and other activities; (9) in the systematic and comprehensive evaluation of science and technology activities, helping to accurately judge the effectiveness of science and technology activities throughout the country, serving as a basis for comprehensively deepening the reform of the science and technology system.

(3) Activities

(1) Effective Science and Technology Evaluation for Policy Adjustment

The direction of development for industry-academia-research collaboration must be the construction of a technology innovation system deeply integrated with market-oriented industry-academia-research with enterprises as the main body. The clear scientific judgments provided by Science and Technology Evaluation Organizations based on the

laws of science and the market and the country's macro context, focus on the capabilities of companies, universities, and R&D institutions in the upstream and downstream of industry. They set out consensus and decision criteria to create a joint innovation ecosystem of industry, academia, and research to promote the integration of diverse factors in innovation. Based on these judgments, science and technology evaluation can be conducted from effective dimensions such as research, industry, and education, systematically analyzing the relationship between science and technology projects and social development/economic situations.

The government is able to produce effective judgments on science and technology management projects through science and technology evaluations, thereby correctly selecting projects. The government needs to consider the mechanisms of technology integration and the direction of technology operation when systematically coordinating planning and policy trends for science and technology management projects. Therefore, it is necessary to use science and technology assessment to establish a systematic and integrated mechanism to effectively harness independent innovation capacity and to further contribute to optimizing and upgrading the competitiveness of the country as a whole on the basis of improved science and technology standards. In the process of science and technology management, science and technology evaluation should not only comprehensively examine the actual inputs and coordination of activities, but also delve deeper into the benefits of science and technology inputs to ensure the establishment and implementation of a fully managed project.

(2) Contributing to Corporate Decision-Making

The process of transferring today's cutting-edge scientific and technological achievements from the laboratory to industrial applications involves significant investment and risk, and a high level of uncertainty. If the value of scientific innovations can be comprehensively, systematically, and quantitatively evaluated, enterprises can make clear decisions. By fully promoting implementation at the strategic and management levels, enterprises can focus on participating in the industry-academia-research eco-chain and incorporate scientific and technological innovation as an important indicator of their annual strategy. Enterprises have advantages in technology and talent accumulation, integration of industry and research, and model innovation. Enterprises need only pay attention to strategy and can make conclusions regarding mechanisms for mature industry-academia-research innovation systems in line with the direction of their development.

The China Association of Science and Technology Evaluation and Management of Scientific and Technical Achievement²⁹ (CASTEM) published and implemented the group standard T/CASTEM 1005-2021: Evaluation Norms for the Capability of Corporate Science and Technology Innovation Systems ("企业科技创新系统能力评价规范") on August 10, 2021. The standard specifies terms and definitions, evaluation principles, indicators, methods, processes, and reports related to the capability of corporate science and technology innovation systems, applicable to evaluation activities conducted by the government, enterprises, and evaluation institutions. The standard evaluates the capability of corporate science and technology research and development capability, science and technology achievement transformation capability, management system support capability, and external condition expansion capability. It strengthens the position of enterprises as the main body of innovation and

²⁹ Established in 1993, the China Association of Science and Technology Evaluation and Management of Scientific and Technical Achievement ("中国科技评估与成果管理研究会") is a social organization registered with the Ministry of Civil Affairs under the supervision of the Ministry of Science and Technology. The association promotes the practical application of research results by serving as a bridge between industry, academia, and research.

supports organic connections in the industry-academia-research chain.

(3) Risk Hedging in Industry-Academia-Research

Scientific and technological achievements are created throughout the entire process of basic research, applied research, technological innovation, and market dissemination. They are inherently multilayered and diverse, requiring the construction of a multifaceted evaluation system for quality, performance, and contribution. Following the issuance of policies such as the breaking away from the "Five Onlys" (only papers, only labels, only positions, only education, only awards) a series of institutional improvements such as the Guiding Opinions on Improving the Evaluation Mechanism for Scientific and Technological Achievements ("关于完善科技成果评价机制的指导意见") were implemented. China's Science and Technology Evaluation Organizations guide researchers at a practical business level to ensure that scientific and technological achievements produce practical effects related to important national needs and economic areas. They thereby encourage researchers to actively engage in the transfer and transformation of results and participate in the industry-academia-research cooperation mechanism.

The current direction of development for science and technology evaluation aims to encourage innovation, accelerate personnel training, promote the transformation and industrialization of scientific and technological achievements, and closely integrate science and technology with economic and social development. The evaluations are focused on scientific value, technological level, and market prospects. These characteristics, in addition to directing research activities towards industrialization, hedge risks in industry-academia-research collaboration, clarify spaces of cooperation and enhance the efficiency of research resource utilization.

2.1.8 Science and Technology Information Service Organizations (科技信息服务机构)

(1) Overview

Science and Technology Information Service Organizations primarily serve as auxiliary organizations to government departments with jurisdiction over science and technology, playing a crucial role in supporting the national science and technology innovation system. Specifically, they provide support for policy decisions to government departments such as those related to science and technology. They also offer information services to the main bodies of science and technology innovation (businesses, universities, research and development institutions, researchers). They also act as centers for managing and sharing services in the field of science and technology information, as well as academic centers, personnel training centers, and network technology research promotion centers.

Science and Technology Information Service Organizations promote scientific research innovation activities and the transformation of research results **by providing the following services in particular**.

(1) Investigating novelty in Science and Technology³⁰

For new products, new technologies, new processes, or new materials proposed by research and development organizations, this process is based on novelty points mainly by using computer searches to obtain closely related literature. A comprehensive analysis and comparison is then performed. This service uses document evaluations to create an assessment of the novelty of new scientific and technological content from perspectives such as basis of

³⁰ Novelty investigation: Refers to integrating literature and information searches in research tasks. Based on literature, the organizations use literature searches and information research to conduct a comprehensive analysis based on their findings, to assess the novelty of projects based on this information, and to create reports that include evidence, analysis, comparison, and conclusions.

argument, research and development objectives, technical routes, technical content, technical indicators, and technical standards.

Science and Technology Information Service Organizations submit a "Science and Technology Novelty Investigation Search Report" to the research organization based on the results of this investigation. These searches help avoid duplication of projects as much as possible, improve the utilization of research funds, and prevent waste and loss of human, material, and financial resources due to repetition in research activities. They also provide an objective scientific basis for the assessment, evaluation, acceptance, transformation, and reward of scientific and technological achievements by departments with jurisdiction over science and technology when making decisions to establish projects.

Although these reports do not have administrative force, they are widely used in various applications such as launching research projects, project verification, patent applications, applications for achievement awards, achievement appraisal, judicial appraisal, fund reporting, high-tech certification, work method reporting, and data collection.

(2) Feasibility Demonstrations and Investment Consulting for Projects

In the transformation of scientific and technological achievements, Science and Technology Information Service Organizations conduct feasibility analysis and consulting for investment decisions regarding new scientific and technological products or projects by companies or investment institutions, providing risk assessment and early warning of market and technology outlooks, competitors, and investment risks. They also provide risk assessment and early warning on market prospects, technology prospects, competitors, investment risks, etc., and make recommendations on feasibility and support investment decisions on new product development by companies or new projects by investment institutions.

The organizations process information inputs from both domestic and international sources and use economic and mathematical models to perform this information processing. They follow certain procedures, not only to process the targeted information but also to elucidate and derive the best technical plan. They conduct broad demonstrations and analyses of technical solutions or scientific and technological projects, ultimately making conclusions and providing feedback to enable optimization and adjustment of objectives. They also support business organizations and individuals to create feasibility study reports, commercial reports for projects, notification documents for innovation funds, and applications for scientific and technological projects according to the needs of the commissioning party and can offer development planning services for science and technology businesses to provide to business organizations.

(3) Matching Various Achievements and Needs and Promoting Project-Level Cooperation between Research and Development Organizations and the Technology Demand Side

Science and Technology Information Service Organizations organize the publication and exhibition of achievements and conduct various technology transfer activities such as integration and intermediation. They also provide online information and consulting about technology projects, scientific and technological achievements, expert teams, and third-party service providers, as well as offer other value-added services centered on expanding the technology transaction service chain.

Technology Information Service Centers generally have an Evaluation Service Center within them, a third-party intermediary organization specializing in the supervision and management of funds for scientific and technological projects. The main services provided include project budget evaluation services, financial reviews of projects, related policy consulting, and training services.

The Evaluation Service Center boasts a professional service team of experts certified by the International TRIZ³¹ Association, national-level innovation trainers, and innovation engineers, possessing extensive experience in longterm corporate training and practical consulting. It offers one-stop services for training personnel in corporate innovation and solving innovation problems.

(2) Activities

(1) Constructing a Network Platform for Industry-Academia-Research Cooperation

Science and Technology Information Service Organizations at each level utilize the internet as a convenient means to promote industry-academia-research cooperation across different academic disciplines and are gradually constructing a network information platform for this cooperation.

The organizations fully leverage the advantages of information networks to build a joint information network for industry, academia, and research aimed at society as a whole, collecting and openly publishing information on corporate technical challenges, the scientific and technological achievements of universities and research institutions, and supply and demand information for personnel. This facilitates timely activities such as bridging information between universities, research and development institutions, and companies, mediating projects, and providing consulting services, as well as promoting collaboration between industry, academia, and research by providing efficient and convenient information channels, thereby encouraging continuous innovation through the cooperation of industry, academia, and research.

In cooperation among industry, academia, and research, the publication of domestic and international scientific and technological achievements, corporate needs, and the latest trends in industry-academia-research cooperation by Science and Technology Information Service Organizations not only strengthens international cooperation and exchange but also realizes the sharing of resources and circulation of information, enabling the provision of innovative and advanced industry-academia-research projects.

Through searches for scientific and technological information, companies can judge the quality of industryacademia-research cooperation projects, and universities can avoid duplicating non-essential academic research. They also enable the government to assess the stage and level of industry-academia-research cooperation. Particularly when government funding supports industry-academia-research cooperation, it is common for the government to first conduct searches and inquiries through Science and Technology Information Service Organizations to ensure they meet national interests when initiating research projects.

(2) Contributing to the Formulation and Implementation of Industry-Academia-Research Strategies

The formulation of industrial plans and industry-academia-research strategies in high-tech parks across regions fundamentally involves the participation of all local Science and Technology Information Service Organizations, whose consulting departments present strategic goals and choices related to scientific and technological innovation and industry-academia-research cooperation, strategic evaluations, breakthrough actions, annual action plans, and medium to long-term development plans based on the information and other resources they possess.

They also collect useful information for decision-making by tracking trends in domestic and international industry-

³¹ TRIZ: A problem-solving theory and overall optimization theory that systematizes and structures problem-solving in inventions, based on the investigation of patent information. TRIZ experts are certified by the International TRIZ Association.

academia-research cooperation, including newly published domestic and international science and technology policies, industrial policies, research and development activities, and research findings related to the development of science and technology by other domestic and international research and development institutions. Furthermore, by classifying, selecting, and processing information, and reporting the research results on trends in industry, academia, and research in the form of bulletins to government sectors and management committees of high-tech parks, they enable government officials involved in the formulation and implementation of industry-academia-research policies to understand domestic and international trends.

2.2 Role of STIAs Focusing on the Cultivation of Start-Up Companies and the Protection and Utilization of Intellectual Property Rights

2.2.1 Incubators

(1) The Establishment of a Low-Cost Mega-Market

Incubators actively form an incubation mega-market³² (commonly referred to as an incubator mega-market in the industry) to facilitate entrepreneurship support by integrating startup and university entrepreneurial resources and attracting investments and financing from investors, etc.

Incubator mega-markets have four major advantages. First, they have a low transaction cost Direct transactions between sellers and buyers do not incur intermediary fees, so the transaction cost consists only of taxes and fees collected by the government, plus a registration fee for the trading platform (assumed to be 1 yuan). Second, transactions are simple and quick. Mega-markets enable face-to-face negotiations, easy price setting, short transaction times, and high efficiency. Third, their cost of information is low. Since startups and entrepreneurs—potential loan recipients—are based in local incubators or incubator clusters, the main businesses, backgrounds, the future development prospects of these startups and entrepreneurs are clearly presented in the incubator mega-market, ensuring high transparency and easy access to information for investors. In addition, local investors and financial companies can easily access and select investment targets such as specific startups and entrepreneurs through the platform, reducing the cost of disseminating information. Fourth, fundraising is dynamic. The combination of crowdfunding and corporate financing in the mega-markets lowers the investment threshold, helping to stimulate the desire to invest idle social capital.

(2) The Transition to a Comprehensive Platform

In practice, incubation mega-markets are transitioning into a comprehensive platform for startups, etc., to solve their challenges. Their essence lies in realizing a process that integrates business incubation to growth acceleration, functional coupling through formal or informal contracts, the construction of an efficient and dynamic complete innovation service chain, and the efficient utilization of innovation service resources.

Incubation mega-markets conduct strict scrutiny and verification for investment promotion campaign projects.

³² An incubation mega-market is a comprehensive trading platform that, based on a regional incubator or incubator cluster, integrates investment promotion campaigns, financing, factor transfers, and comprehensive services.

Incubation mega-market investment promotion campaign platforms include various content such as project recommendations, performance explanations, loan advertising, product dissemination, and online discussions.

Incubation mega-markets provide a factor transfer platform under expanded property rights ("大産権"). Expanded property rights extend the concept of original property rights, covering various interests such as stocks, bonds, property rights, intellectual property rights, ownership of forests, and environmental rights. Rights associated with science and technology achievements are ownership and usage rights, but to maximize the early utilization and market value of outcomes, incubators, with the cooperation of financial institutions, develop financial products that can be traded based on ownership and usage rights, such as bonds. Ownership and usage rights are expanded property rights, and the financial products based on them are factors.

These platforms realize three major functions. First, they promote the conversion of state-owned enterprises and state-owned capital. Incubation mega-markets provide various service models to various market entities, such as corporate restructuring, investment and financing, and project attraction, to involve private investment in the restructuring and reorganization of state-owned enterprises, promoting the development of mixed ownership. Specialized investment funds are also introduced in a timely manner to cultivate the international competitiveness of state-owned enterprises.

Next, the markets build specialized platforms such as stock registration management centers, creating a marketbased comprehensive platform that integrates stock trading (including bonds, intellectual property rights, property rights, forest ownership rights, financial products, environment, mineral products, oil, gold, etc.), entrusted management of stocks, and e-commerce services, providing enterprises with a comprehensive platform for factor transfer. In particular, they construct good exit channels for venture capital companies.

Finally, they establish financial factor trading platforms³³, providing functions for the registration and entrusted management of financial assets and transactions, and actively facilitating the use and transaction services of specific types of asset securitization products, such as revenue rights of microcredit assets, revenue rights of trust products, and revenue rights of accounts receivable and financial lease assets.

(3) The Rapid Growth of Venture Capital Incubators

Venture capital incubators, a new development in recent years, are businesses belonging to a subsector of the incubation industry, providing incubation and nurturing services for venture capital (angels, private equity funds, etc.). Specifically, in addition to risk assessment when venture capital invests in venture companies, they provide consulting services that include everything from investment fund management to fund recovery. The emerging industry of venture capital incubators does not invest in venture companies directly but advises financial institutions that invest in them.

Based on the identity of participants, venture capital incubators are divided into full-course financial service venture capital incubators and specialized incubators within the venture capital industry. Full-course financial service venture capital incubators are capable of providing services such as venture capital risk education and venture capital participation evaluation. Furthermore, by collaborating with top professional investment institutions in China's

³³ A factor trading platform is a third-party transaction security guarantee platform related to production factors, including labor, land, capital, science and technology, and information.

venture capital industry and under the philosophy of professional venture capital, they guide venture capital entities in fundraising, investment, management, and exit, while linking these activities to practical effects. They also provide specialized ranking evaluations and financial services support during the growth process of venture capital entities.

The venture capital incubation industry is experiencing rapid growth due to policy support for the incubation industry. At the current stage, China's venture capital incubation industry is still in its infancy, with the number of venture capital incubators not yet reaching 20, but it is expected that the growth rate of the venture capital incubation industry will exceed that of traditional incubators, maintaining an annual growth rate of over 20%. The number of venture capital incubators in China is expected to exceed 50 by 2023.

Leading players in China's venture capital and incubation sector are initiating customized service offerings, broadening the availability of specific amounts of Private Placement Notes (PPNs)³⁴ and corporate bonds by leveraging innovative products like sustainable corporate bonds. This approach creates a diverse ecosystem where multiple financial instruments, including corporate bonds, PPNs, medium-term bills, short-term loans, and ultra-short-term loans, are issued alternatively.

Startups, etc., secure the stability of funding sources for bank loans by obtaining credit lines³⁵ from banks in various sectors, including state-owned banks, policy banks, foreign banks, and other Chinese capital banks. Venture capital incubation companies promote the diversification of their own lending routes by smoothly utilizing indirect lending routes and comprehensively using bond issuance and asset securitization. This reduces dependence on single products/markets and achieves financial geographical diversification, thereby lowering capital costs and enhancing the market competitiveness of the corporate debt side.

For example, Far East Horizon Ltd.³⁶, a well-known company in the industry, adheres to the "globalization of resources" strategy according to its own strategic development needs, effectively adjusting the allocation of direct and indirect lending in real-time based on domestic and foreign financial environments, achieving advantages in lending costs compared to peers.

(4) Establishment of Entrepreneurship Service Centers in Government-Led High-Tech Industrial Development Zones

Incubators are also a birthplace for the transformation of scientific and technological achievements.

One of the most important initiatives undertaken by the Chinese government to quickly transform the outcomes of science and technology into productive forces was the establishment of entrepreneurship service centers (i.e., incubators) in high-tech industrial development zones. As a result of over 20 years of diligent exploration and putting innovation into practice, incubators have become a vitally important and effective organization for promoting the transformation of China's scientific and technological achievements.

³⁴ Private Placement Notes (PPN): Bonds privately issued by non-financial companies to specific investors.

³⁵ A credit line refers to the inventory management indicator for short-term credit assessed by commercial banks for customers.

³⁶ Far East Horizon Ltd. is a comprehensive financial and industrial group established in Hong Kong. Hong Kong and mainland China are its main areas of business, but it operates globally. It was listed on the Hong Kong Stock Exchange in 2011.

2.2.2 Productivity Promotion Centers

(1) Incubation Services Also Provided

Productivity Promotion Centers actively guide various financial institutions to increase investment in science and technology-type small and medium-sized enterprises through platform-like professional services, support the construction and improvement of the credit system for these enterprises, and guide and support enterprises to steadily enter the capital market which has diverse investors and investment institutions. In addition, to expand the financing channels for emerging science and technology-type innovation enterprises, they actively participate in services such as major stock markets, emerging stock markets, share transfer systems, venture capital, guarantees, and technology property rights trading, leveraging government-related funds to build a financial service chain and guide social capital to expand investment in these emerging enterprises.

They actively constructing group innovation spaces and service platforms, providing services such as policy guidance, corporate diagnostics, strategic planning, information services on intellectual property rights protection, product design and development, technological development services, product planning for small and medium-sized enterprises, channel matching for marketing, and investment promotion campaigns to promote the transformation of scientific and technological achievements. The centers also meet the specific needs of incubation, enterprise technological innovation, and product upgrades.

At the same time, Productivity Promotion Centers offer services tailored to the specific needs of innovation and entrepreneurship, as well as services for training and tracking management of carriers of innovations and entrepreneurs, and performance evaluations.

(2) Establishing Systems to Produce Intellectual Property Rights for Enterprises

Intellectual property rights are an innovation resource that enhances the core competitiveness of industries and enterprises. Productivity Promotion Centers in each region actively promote the construction of enterprise intellectual property rights creation systems to strengthen core competitiveness through the protection and transformation of intellectual property rights, aiming to operate patents based on market needs. The information disclosure and guidance through the centers' platforms supports governments at various levels, such as central, provincial, city, and county governments. The platforms focus on goals that can lead industrial development with strategic and future potential, playing a guiding role in various special project funds, and expanding various forms of support for valuable patents.

Regular seminars and training sessions are held to guide the development of patent information operation capabilities of small and medium-sized enterprises. They also help enhance the patent information analysis and operation capabilities of enterprises, reduce innovation risks, and promote the deep integration of patent information analysis and industrial management decisions. The centers also promote advanced matching between patent creation and industrial innovation and optimize patent creation through patent navigation³⁷.

In addition, productivity promotion centers in places like Beijing have established patent and trademark guidance

³⁷ Patent navigation: An exploratory process that integrates patent operation into industrial technological innovation, product innovation, organizational innovation, and business model innovation based on the utilization of patent information resources and patent analysis, guiding and supporting the scientific development of industries.

stations ("专利及商标指导站") to guide and support various market players in solving issues related to trademark and brand creation, management, rights protection, and market development, providing a wide range of intellectual property services.

(3) Helping Improve the Quality and Efficiency of Intellectual Property Services

Productivity Promotion Centers in various regions are actively exploring new models of intellectual property services to fully leverage intellectual property rights that support science and technology innovation and enhance the creation and operation capabilities of intellectual property rights in science and technology. These primarily include patent navigation services for key industries, patent status analysis services, consulting services related to the construction of intellectual property rights examination and demonstration parks, intellectual property rights analysis and evaluation services for major economic activities, intellectual property rights (patents) big data system services, enterprise intellectual property consulting services, construction of individual patent databases for enterprises, early warning analysis services for product market circulation, product patent navigation analysis services, enterprise intellectual property rights strategic planning services, analysis services for domestic and foreign competitors' information, services for thorough compliance with enterprise intellectual property standards, and patent financial services.

At the same time, to accelerate the integrated development of intellectual property services and industrial innovation, Productivity Promotion Centers in Jiangsu Province, Shanghai, and Shenzhen are actively deploying specialized services such as technology transactions, investment and financing, and judicial appraisals, enhancing the quality and efficiency of intellectual property services, and enabling the construction of a modern industrial system that can be self-managed. These are all important guidelines for Productivity Promotion Centers to promote the protection and operation of patents in the future.

2.2.3 Technology Achievement Transformation Centers

(1) Providing Matching with Optimum Companies

Many startups have strong innovation capabilities but lack the ability to judge what needs exist or how to link them to societal development and market needs. One major weakness of startups in particular is predicting government macro policies and national/regional development and responding accordingly.

The Technology Achievement Transformation Centers, leveraging their advantages as government-supported platforms, can send related innovation needs to companies after research and evaluation, and perform matching with the most suitable companies through the integration of government resources.

At the same time, the Technology Achievement Transformation Centers have presented a series of significant industrial directions based on local development trends. These include numerous innovation needs and needs for the transformation of scientific and technological achievements, facilitating technology accumulation and development or innovation partnerships through exchanges with enterprises and universities, integrating several needs and startup models on the center's platform, and laying the foundation for the future development of science and technology innovation enterprises and startups.

(2) Required Intellectual Property Protections and Flexible Operation in Projects

Intellectual property rights are core interests in the process of transforming scientific and technological achievements

and are an important premise for determining other interests. The government needs to actively promote the implementation of intellectual property policy measures for industry-university-research cooperation through guiding organizations such as the Technology Achievement Transformation Centers. The following aspects need to be strengthened in specific projects led by the Technology Achievement Transformation Centers for the protection and flexible operation of intellectual property rights.

(1) Fully leveraging the "private right nature of private property rights" and enforcing the principle that "the completer enjoys the benefits." That is, for projects that do not require government intervention, the intellectual property rights of the results should be transferred to companies or universities, respecting the intellectual property rights that belong to the multiple organizations that produced them. For projects that require government intervention, the Technology Achievement Transformation Centers should caution the parties to pre-determine matters related to the transfer of intellectual property rights, including the distribution of benefits from the results, in contracts.

(2) Pay attention to the role of additional clauses in government project contracts and utilize them, clarifying the conditions of intellectual property rights according to the characteristics of science and technology achievements transformation projects and the main rights and obligations that are considered to arise through them, through the formal clauses provided by the Technology Achievement Transformation Centers.

(3) The content related to intellectual property rights in the standard terms provided by the Technology Achievement Transformation Centers includes the attribution, exercise (implementation, licensing, transfer, shareholding, etc.), and revenue distribution of intellectual property rights. Confidentiality clauses involve additional rights and obligations of enterprises, universities, and government departments with jurisdiction, and additional rights and obligations of enterprises and universities.

(4) As a third party representing the government, the Technology Achievement Transformation Centers can request enterprises and universities to establish standard and effective intellectual property management systems, such as patent management systems and trade secret management systems, to strengthen the protection of intellectual property rights of scientific research results.

2.2.4 Technology Property Right Exchange Organizations

(1) Realizing Comprehensive Management Services for Intellectual Property

Technology Property Right Exchange Organizations, using the perspectives of "technology," "property rights," and "transactions," have played an important role in leveraging the capital leverage effect of science and technology finance through intellectual property rights evaluation and in the strategic use of intellectual property rights in corporate strategy. Exchange Organizations in various regions essentially have six core functions: consulting, agency, evaluation, transaction, management, and training.

The Technology Property Right Exchange Organization platform has enabled integrated management and packaged services of intellectual property rights, saving service costs and realizing a systematic intellectual property service system. In addition, this platform has realized various service functions related to intellectual property rights (digital digest database searching, consulting, education, evaluation, etc.).

(2) Solving Financial Needs through the Capitalization of Intellectual Property Rights

Financial models have a significant impact on the development process of the intellectual property rights business.

Technology Property Right Exchange Organizations attract financial institutions through the capitalization of intellectual property rights, solving the financial needs of startups, etc. They operate innovative financial products such as intellectual property rights pool trusts³⁸, patent operation funds, and intellectual property rights secured financing, realizing services with high added value under an appropriate evaluation system.

The organizations, leveraging their experience in intellectual property rights services, have designed a science and technology financial service chain combining intellectual property value assessment, intellectual property security, share ownership security of science and technology-type enterprises, etc., introducing financial services for emerging science and technology-type enterprises.

Technology Property Right Exchange Organizations in various regions are now relatively mature and provide three main routes of financial support. First, introducing government funds to participate in the investment and financing of science and technology-type small and medium-sized enterprises. The introduction of government funds increases capital, and the subsequent entry of funds from multiple financial institutions such as banks and investment institutions reduce the cost of securing funds for startups, etc.

Next, matching the capital characteristics of Technology Property Right Exchange Organizations and financial institutions, customizing funding solutions according to the intangible assets held by startups, etc., and collaborating with many financial institutions to plan mezzanine investment³⁹ products that combine intellectual property rights and shares, meeting the shared needs of financial institutions and enterprises, and providing new funding products for startups, etc.

Finally, intellectual property rights are gradually being accepted and recognized in the financial market as the core assets of science and technology-type enterprises. As a platform for technology and intellectual property rights, Technology Property Right Exchange Organizations promote and publicize through various channels, creating a favorable lending and social atmosphere for the flexible operation of the intellectual property of science and technology-type enterprises.

2.2.5 Science and Technology Financial Service Organizations

(1) Developing "One Enterprise, One Strategy" Customization Plans

Currently, domestic Science and Technology Financial Service Organizations adopt a service model primarily featuring third-party rating + investment and financing linkage + policy guarantee for financial services targeting science and technology innovation enterprises, providing support in terms of funds and policies during the seeding, startup, and growth phases of these enterprises.

These organizations are formulating One Enterprise, One Strategy customized development plans for science and technology innovation enterprises, offering dedicated credit products for the startup phase such as angel loans, trademark loans, and talent loans. Based on interest subsidy policies, they provide science and technology-type

Pool trust ("Collective Trust"): A method where a trustee collects trust property (movables, immovables, intellectual property rights, etc.) entrusted by two or more consignors, managing, operating, and disposing of the entrusted property in the trustee's own name.

³⁹ Mezzanine investment ("夹层投资"): A form of investment that flexibly combines the advantages of stock investment and bond investment.

startups with loan rates below 5.5% or seamless renewal loans⁴⁰, in addition to financial support during the seeding, startup, and growth phases, contributing to the reduction of financing costs and loan repayment costs.

This model first involves introducing third-party credit rating agencies, and based on data provided online and offline by various levels of financial comprehensive service platforms, corporate internet service platforms, government departments, and the credit departments of financial institutions, it offers comprehensive quantitative scores and detailed, all-encompassing portraits to science and technology-type enterprises, conducting financial support through a multi-faceted operation of lending, investment, and administrative services.

Through this model, financial services related to investment and financing are provided to science and technologytype startups. Small and medium-sized enterprises in this field with small asset sizes are provided with innovative products cooperatively developed by Science and Technology Financial Service Organizations and banks, such as science and technology intelligence loans, science and technology support guarantee loans, and intellectual property rights loans. Furthermore, Science and Technology Financial Service Organizations continually enhance corporate fundraising functions through supply-side reforms, expanding the scope of capital market services by promoting cooperation between the venture company stock market and industrial parks as third-party fund collaboration platforms, cooperating in the issuance of new products in the bond market, and strengthening ongoing support for innovation and entrepreneurship.

In recent years, policies providing support from the central to local governments have promoted the development of intellectual property rights financing, leading more Science and Technology Financial Service Organizations to venture into intellectual property rights secured financing services. Under the national strategy supporting science and technology innovation, China Construction Bank has developed an innovation capability evaluation system for science and technology enterprises, examining companies from various angles such as intellectual property collateral and technology rating models, producing innovation in science and technology achievement transformation loans, and enhancing support for enterprises transforming scientific and technology achievements through an intellectual property rights collateral loan + investment and financing linkage method.

(2) Diversifying Risk-Sharing Mechanisms Regionally

Science and Technology Financial Service Organizations across regions are gradually diversifying risk-sharing mechanisms for intellectual property rights secured financing, with three representative models emerging in Beijing, Pudong, and Wuhan. The Beijing model is a government-led direct secured financing model of banks + intellectual property rights. This model involves lending to small and medium-sized enterprises with the help of financial institutions and Science and Technology Intermediary Agents who provide investment and financing, where the government primarily integrates resources, builds platforms, and supports interest subsidies for qualified enterprises, based entirely on marketization.

The Shanghai Pudong model is a government-led indirect secured financing model of: bank + government fund collateral + intellectual property rights counter-guarantee.⁴¹ Pudong New Area has established a special fund of 20

⁴⁰ Renewal loans refer to a term used in the banking and finance industry, where an individual who has already received a loan from a bank can continue to receive another loan based on creditworthiness and appropriate collateral.

⁴¹ Counter Guarantee, also known as a credit guarantee, refers to a guarantee established by the debtor or a third party to ensure the realization of the guarantor's claim against the principal debtor after the guarantor has assumed the guarantee responsibility.

million yuan to guarantee loans to enterprises, where startups pledge their intellectual property rights as a counterguarantee to Pudong New Area, and banks provide loans to these startups.

The Wuhan model is a government-led hybrid model of bank + science and technology guarantee company + intellectual property rights counter-guarantee. It reduces the government's burden in indirect models while partially mitigating the bank's risk.

Various Science and Technology Financial Service Organizations are exploring new models of intellectual property financial services, such as intellectual property stock investment, custody and operation of intellectual property rights, securitization of intellectual property rights, and futures trading rights for intellectual property rights, attempting to build financial and operational service platforms covering the entire value chain of intellectual property marketization.

2.2.6 Patent Agencies

(1) Legal Protection of Intellectual Property Rights

In recent years, venture company hotspots have gradually shifted from traditional manufacturing and financial services to high-tech industries such as information technology, the internet, biotechnology, and smart manufacturing, with this trend particularly evident in frontier technology fields like big data, artificial intelligence, and cloud computing. These companies' greatest asset is their intellectual property rights, centered around patents.

With technologies like big data, artificial intelligence, and cloud computing in their development phase, legal protection for the intellectual property rights of these intangible assets is also developing, making it challenging to predict and grasp legal risks, which need to be identified and prevented. Should any issues arise with intellectual property rights, it could potentially lead to a crisis threatening the survival of these venture companies. A key challenge for venture companies is finding ways to have their advanced, marketable technology recognized by society as property rights, such as patents, and secure capital backing. For many high-tech companies, having an effective intellectual property rights strategy is a top priority.

Venture companies need to apply for and obtain patents before mass-producing products for commercial purposes. Similarly, venture capitalists need to clarify intellectual property ownership before investing. Among various forms of technological protection, patents are considered the most effective.

Patent agencies can provide emerging venture companies with means for the establishment and maintenance of intellectual property rights by offering patent protection solutions. Additionally, before investment and operation, founders must verify the ownership of patents with the help of specialized Patent Agencies. If intellectual property rights are attributed to the company rather than individual founders, it prevents founders from taking these rights upon leaving and avoids risks for the venture company.

(2) Intellectual Property Protection and Operation for Cutting-Edge Venture Companies

Property issues surrounding data have been a topic of discussion in the field of big data in recent years. The current trend is to consider this data to be intellectual property, but whether to protect it with copyright or patents is still undecided. Generally, technical inventions that include data providing specific technical solutions can be protected by patents. Completed databases are protected as compilations under copyright law if they have originality, while databases without originality are protected by trade secrets or contract law. Among peers in the same industry, with investment and effort big data can be protected through claiming exclusive rights.

For artificial intelligence, traditional patent criteria (novelty, inventiveness, practical applicability), are influencing intellectual property protection. Who owns patents for artificial intelligence and whether to adopt an investor model or a creator model remains an issue under debate. Given these circumstances, the solutions offered by patent agency institutions involve specifically leveraging regulations related to employment creation and commissioned inventions and defining patent ownership through contracts to protect investors' interests.

Cloud computing is also impacting the traditional intellectual property rights system. Cloud computing allows remote access to data and programs on the cloud from internet-connected devices like smartphones and laptops, providing processing and storage of resources. It enables users to access music, movies, and books without downloading them. This model seriously conflicts with the traditional copyright protection model - which is based on copying and reproduction - and is not yet covered by current laws. Relevant patent protection methods still center around the Anti-Unfair Competition Law and Contract Law, with the patent agency industry actively proposing legal amendments and new legislation.

2.2.7 Science and Technology Evaluation Organizations

(1) References for Bank Lending and Technology Insurance Decision-Making

The formal conclusions issued by Science and Technology Evaluation Organizations are recognized as nationally approved, authoritative evaluations within the industry. Members of the evaluation committee are nationally recognized experts, and the professional consulting and evaluation conclusions obtained through their evaluations and certifications, or careful reviews are authoritative, significantly enhancing the value of scientific and technological achievements.

The evaluation results offer crucial, foundational information. This information helps promote the transformation of scientific and technological accomplishments in emerging businesses and innovation enterprises. It is useful in various areas, including registering scientific and technological achievements, starting scientific research projects, and receiving approval for production licenses. They also aid in the transfer and sale of technological achievements, evaluating science and technology assets, and promoting and disseminating technological achievements. Furthermore, it supports companies to apply to become national high-tech enterprises and assists in accessing the Science and Technology-Type Small and Medium Enterprises Technology Innovation Fund at both provincial and national levels. Additionally, the accreditation results of the Science and Technology Evaluation Organizations serve as crucial decision-making material in the accreditation and application for accreditation of science and technology achievement transformation projects at the national or provincial level.

In particular, startups accredited by these organizations as high-tech achievement transformation projects can receive policy support related to the transformation of technological achievements, such as tax incentives. The existence of Science and Technology Evaluation Organizations serves as a reference for decision-making in venture capital, bank lending, science and technology insurance, and technology transactions, offering solutions to issues that hinder the development of science and technology-type startups, such as information disparity between technology and industry.

With the initiation of science and technology support policies related to the 14th Five-Year Plan, local governments plan to establish guiding funds and support funds as financial aid measures for high-growth startups at a very low cost. Currently, although there is social capital available, there are few good projects, and various routes are being explored to find good investment opportunities. The consulting and evaluation activities by these organizations become a crucial means for government capital and social capital to find investments. Enterprises that pass the science and technology evaluation have far more opportunities to receive capital than those that do not, maximizing the transformation and application of technological achievements in the industrial chain.

(2) Comprehensive and Multi-Faceted Evaluations of Intellectual Property Rights

Science and Technology Evaluation Organizations position intellectual property rights within a broader context, considering relationships with external environments such as politics, economics, law, and supply and demand, and using various methods such as mathematics, economics, statistics, and computers for evaluation. Thus, the evaluation of intellectual property rights needs to be comprehensive and multi-faceted. Also, when conducting evaluations, the dynamics of social and industrial development must be fully considered.

At the moment, it is common for Science and Technology Evaluation Organizations to make comprehensive judgments on intellectual property rights based on a combination of broad and detailed indicators. This trend also applies to the National Center for Science and Technology Evaluation⁴² under the Ministry of Science and Technology. Generally, the broad indicators include the following: (1) Technological level (legal protection of intellectual property rights, achievement innovation points, whether the core technology is currently seen as "advanced" domestically, whether the production processes for the product are reasonable), (2) industrialization foundation (whether technical issues during the industrialization process can be solved with raw materials, factories, facilities, and relatively strong research and development capabilities, whether sufficient funds can be obtained to support the transformation of results during industrialization, etc.), (3) the market situation (whether market research can provide an accurate market position before the research and development of scientific and technological achievements, whether there is sufficient market demand after scientific and technological achievements become products, whether similar substitute products exist in the market or are likely to appear in the long term, whether a clear competitive advantage can be formed in terms of function, cost, price, etc.), (4) social benefit (whether industrialization can promote regional industrial restructuring, employment, economic growth, and effective utilization of regional resources, while preventing environmental pollution and waste of resources), (5) risk (technical risk, business risk, market risk).

By leveraging their expertise and social resources and fully utilizing intellectual property evaluation regulations, the Science and Technology Evaluation Organizations can effectively provide matching services for the financing, evaluation, and transfer of scientific and technological achievements (intellectual property rights), suitably evaluate the market value of intellectual property rights, and promote the transformation of scientific and technological achievements.

⁴² The National Center for Science and Technology Evaluation is a direct business organization of the Ministry of Science and Technology. It is a national-level Science and Technology Evaluation Organization with independent corporate status. It was established in 1997.

2.2.8 Science and Technology Information Service Organizations

(1) Preparing Technology Roadmaps⁴³ Tailored to the Development of Startups

To ensure startups and venture companies, including those originating from universities, enter a stable development phase as soon as possible, the internal consulting departments of the Science and Technology Information Service Organizations specially prepare technology roadmaps tailored to their development. The organizations support startups in identifying the core technologies necessary for future growth, the resources required for their development, and routes of implementation, ensuring the scientific planning, implementation, and marketization of the startup's core technologies.

The core of startups is technology, and through the advantages of their information platforms, Science and Technology Information Service Organizations clarify the demand for scientific and technological products and the current situation and market environment of the industry by analyzing the domestic and international market environment, industrial structure, competitive relations, government policies, and the current situation and trends of technological development. They also extract core technologies in the process of industrialization according to the main performance of scientific and technological products and provide beneficial guidance for the research and development and growth of these core technologies and products.

Additionally, one special service of the Science and Technology Information Service Organizations is industry research reports for initial public offerings (IPOs). The industry survey report for startups' IPOs includes the following: (1) Policy feasibility: Mainly based on related industrial policies, demonstrating the feasibility of project investment and construction, (2) Market feasibility: Mainly based on market research and forecast results, determining the market positioning of the project, (3) Technical feasibility: Mainly focusing on comparisons and evaluations of technological options adopted in the project. They compare competitors of, substitutes for, and parameters of the product, clarifying the competitive advantages of the core technologies of startups, obtaining approval from experts in scientific and technological projects, and proposing solutions for launching new products to the market.

(2) Covering Weaknesses for Investment Companies Targeting Startups

Investment companies targeting startups tend to focus on financial and accounting analysis, lacking an understanding of the technical current state and market outlook of the project. Therefore, Science and Technology Information Service Organizations conduct comprehensive feasibility studies and evaluations of technology projects and investments in startups from aspects such as technology, market, competitors, and investment risks, and through evaluation and consulting, providing investment companies with routes to realize the industrialization of technology and the IPO of startups from the perspective of science and technology information.

Science and Technology Information Service Organizations serve as a comprehensive science and technology service platform integrating science and technology information. They play a crucial role as the eyes and ears in the decision-making of significant national science and technology policies and the planning and project design of scientific research entities. More importantly, they act as a brain and think tank for the policy decision-making

⁴³ Technology roadmap: A document or diagram that represents a strategic plan for introducing technology within a specific organization, summarizing the types of technology to be introduced, the timing, and the reasons. They aim to help avoid high-cost failures and anticipate the obsolescence of technology.

activities above, supporting the formulation of high-end, strategic, and comprehensive science and technology policies.

The professional, full-time staff of Science and Technology Information Service Organizations have engaged in information activities closely related to scientific and technological activities over the long term. In addition to their professional foundation, they are also highly skilled in collecting, collating, and analyzing information, allowing them to effectively and deeply analyze and survey information such as patents and develop strategies and tactics with significant advantages.

To leverage the rich information content and high expertise of Science and Technology Information Service Organization platforms, institutions across regions provide service functions such as patent search, statistical analysis, information consulting, early warning services, patent literature translation, patent information management, patent trend surveys, patent database construction, and online patent display, integrating and processing domestic and international patent information resources, and providing patent technology support and value-added services for corporate innovation, as well as industrial or industrial patent analysis and early warning consulting for government departments and industry organizations.

In recent years, Science and Technology Information Service Organizations in Zhejiang Province, Shanghai, and Beijing, in cooperation with departments with jurisdiction over of intellectual property rights, have established intellectual property rights support service centers on their platforms and opened hotlines for rights protection reporting and complaints regarding intellectual property rights, leveraging their information advantages to provide patent protection and reasonable convenience based on law.

3 Size, Regional Distribution, and Revenues of STIAs

3.1 Incubators

(1) Scale of Development

According to the China Startup Incubation Development Report (2022) published by the Ministry of Science and Technology's Torch Center in 2022, in 2021, the number of incubators nationwide, including Group Innovation Spaces, reached 15,253, of which 6,227 were incubators (including 1,287 at the national level) and 9,026 were Group Innovation Spaces (of which 2,551 were reported to the Chinese Government).

In 2021, incubators conducted 249,000 innovation and entrepreneurship activities, a 5.9% increase from the previous year. Entrepreneurial education and training sessions were held 102,000 times, and entrepreneurial guidance for enterprises was conducted 222,000 times in total. By the end of 2021, a total of 384 training sessions for entrepreneurial talents had been conducted nationwide by national-level incubators and local industry associations, with 43,000 participants.

In 2021, 1,553 incubators actually received tax incentives, reaching a tax reduction amount of 1.11 billion yuan. The total incubation funds of incubators nationwide amounted to 266.409 billion yuan, a 40.68% increase from the previous year. Nationwide, incubators received investment from 36,000 enterprises and teams within one year, a 15.69% increase from the previous year.

In 2021, companies and teams that had received incubation services from incubators nationwide held 1.41 million active intellectual property rights, including 210,000 invention patents. The total research and development expenditure of companies served by incubators was 83.147 billion yuan, a 2.83% increase from the previous year, with the average research and development investment of incubated companies accounting for 6.68% of sales. The number of science and technology-type small and medium-sized enterprises receiving incubation services increased by 28.9% compared to the same period in the previous year, and high-tech enterprises increased by 11.1%.

In 2021, the incubators provided incubation services to approximately 698,000 enterprises and entrepreneurial teams, attracting employment for 4,983,200 people, a 3.5% increase from the previous year, including 501,000 recent university graduates. Classified by entrepreneurial entities, there were 165,000 student entrepreneurs, 96,000 science and technology entrepreneurs, and 18,000 overseas student entrepreneurs. Personnel with a bachelor's degree or higher in incubated companies accounted for nearly 80% of the total, totaling 2,429,100 people.

(2) Regional Distribution

The following data is based on the 2021 China Torch Statistical Yearbook, which was current as of this year (2020). Notable incubators include the Beijing High-Tech Entrepreneurship Service Center ("北京高技术创业服务中心"), Tianjin Science and Technology Entrepreneurship Service Center ("天津市科技创业服务中心"), Shanghai Science and Technology Entrepreneurship Center ("上海市科技创业中心"), and Guangzhou Torch High-Tech Entrepreneurship Service Center ("广州火炬高新技术创业服务中心").

Region	Number of Incubators			
Total	5843			
Eastern Region	3693			
Central Region	893			
Western Region	872			
Northeastern Region	385			
Beijing	246			
Tianjin	104			
Hebei	274			
Shanxi	68			
Inner Mongolia	50			
Liaoning	93			
Jilin	94			
Heilongjiang	198			
Shanghai	165			
Jiangsu	928			
Zhejiang	437			
Anhui	208			
Fujian	134			
Jiangxi	79			
Shandong	318			
Henan	181			
Hubei	250			
Hunan	107			
Guangdong	1079			
Guangxi	116			
Hainan	8			
Chongqing	116			
Sichuan	192			
Guizhou	47			
Yunnan	44			
Tibet	4			
Shaanxi	151			
Gansu	77			
Qinghai	15			
Ningxia	23			
Xinjiang	29			
Xinjiang Production and Construction Corps	8			

Number of incubators by region (2020)

Source: 2021 China Torch Statistical Yearbook

(3) Revenue

According to the China Startup Incubation Development Report (2022), the total revenue of incubators in 2021 was 80.176 billion yuan, and the amount of tax reduction and exemption reached 1.11 billion yuan. The annual total revenue of incubated companies reached 1.24 trillion yuan. They held 1,411,000 active intellectual property rights including 212,000 invention patents. The number of incubated companies increased by 28.9% for small and medium-sized enterprises and 11.1% for high-tech companies compared to the previous year.

3.2 Productivity Promotion Centers

(1) Scale of Development

According to related data from the 2021 China Torch Statistical Yearbook, as of the end of 2020, the total number of Productivity Promotion Centers included in the national statistics was 1,186, with 15,922 employees, and total assets worth 37.45 billion yuan. The number of companies served was about 183,000, the annual service income of the centers was 2.325 billion yuan, and the sales increase of the companies served totaled 229.5 billion yuan, with taxes of 9.83 billion yuan and an increase in employment of 445,000 people.

(2) Regional Distribution

Productivity Promotion Centers are distributed across 31 provinces, cities, and autonomous regions in China, with a relatively high concentration in Heilongjiang, Jiangxi, Anhui, Guangdong, and Sichuan provinces. Below is the national distribution map of centers based on the 2021 China Torch Statistical Yearbook.

Notable productivity promotion centers include the Zhongji Productivity Promotion Center ("中机生产力促进中心"), Guangdong Province Productivity Promotion Center ("广东省生产力促进中心"), Shandong Productivity Promotion Center ("山东火炬生产力促进中心"), China Building Materials Industry Productivity Promotion Center ("中建材行业生产力促进中心"), and Jiangsu Province Productivity Promotion Center ("江苏省生产力促进中心").

Region	Number of Centers	Number of Employees	Total Assets (Thousand Yuan)	Government Investment (Thousand Yuan)	Annual Total Service Income (Thousand Yuan)	Office Area (m ²)
Total	1186	15922	37445043	840888	2325174	907655
Eastern Region	312	5655	24957344	401609	898546	275593
Central Region	356	4311	6880354	133446	779060	334777
Western Region	474	5234	5332496	297734	575406	269767
Northeastern Region	44	722	274849	8099	72162	27518
Beijing	7	583	3179228	39768	83752	9070
Tianjin	51	875	486138	1150	178836	48754
Hebei	41	558	118751	13881	100317	8301
Shanxi	27	200	13945	18591	130	3206
Inner Mongolia	57	465	256869	10689	9755	18742
Liaoning	12	264	150971	-	8097	11848
Jilin	5	148	79218	4393	3240	6105
Heilongjiang	27	310	44660	3706	60826	9565
Shanghai	5	113	166804	-	15339	2619
Jiangsu	30	765	1009060	194636	38457	23165
Zhejiang	6	237	523578	1250	57460	14570
Anhui	120	1744	1772780	23445	471652	127074
Fujian	48	502	17892557	33461	23948	35273
Jiangxi	124	1315	822420	41514	142019	94279
Shandong	32	364	318434	14238	29960	16578
Henan	17	352	263773	16081	23839	25788
Hubei	44	468	3680755	20420	95499	42096
Hunan	24	232	326680	13397	45921	42335
Guangdong	92	1658	1262794	103225	370476	117264
Guangxi	53	562	273487	42549	12003	22763

2020 National Distribution of Productivity	Promotion Centers
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Source: 2021 China Torch Statistical Yearbook

Specific numbers and frequency of services performed by regional Productivity Promotion Centers

Region	Consulting Services (Total Number)	Number of Cases of Information Provided	Technical Services (Total Number)	Training Services (Total Number of People)	Intermediary Services (Total Number)	Incubation Services (Total Number)
Total	72890	18894937	29427	997518	10295	20852
Eastern Region	20948	15285592	13384	374051	2333	3927
Central Region	18455	1180618	7765	156670	4661	3468
Western Region	31556	2407386	7255	393943	2875	12473
Northeastern Region	1931	21341	1023	72854	426	984
Beijing	201	307556	1251	21919	12	10
Tianjin	3961	11730282	1136	19890	513	720
Hebei	1776	211638	1003	31104	572	829
Shanxi	710	27820	34	15997	62	27
Inner Mongolia	1829	109614	331	17685	171	204
Liaoning	236	5684	120	2463	68	17
Jilin	718	9307	459	4164	344	403
Heilongjiang	977	6350	444	66227	14	564
Shanghai	6	100	28	337	-	-
Jiangsu	6669	314320	1209	27169	782	1141
Zhejiang	53	4129	234	7063	43	78
Anhui	9295	342060	3353	70292	2261	823
Fujian	715	914746	784	44149	224	391
Jiangxi	3552	122701	1394	25017	788	1072
Shandong	2076	721737	1472	128560	48	386
Henan	1025	573909	727	5537	222	164
Hubei	3012	106392	1566	27778	353	770
Hunan	861	7736	691	12049	975	612
Guangdong	5491	1081084	6267	93860	139	372

Source: 2021 China Torch Statistical Yearbook

(3) Revenue

Examining the main services of over 1,000 productivity promotion centers nationwide, reveals services including: Sanno⁴⁴ services, industrial subcontracting, training services, public service platforms, industrial design, credit rating, technology transactions, technology transfer, enterprise incubation, decision-making consulting, enterprise diagnostics, service platform sharing, science and technology finance, and international exchange & cooperation, etc.

The number of companies served by productivity promotion centers and their income has been increasing year by year. According to the 2021 China Torch Statistical Yearbook, the annual total service income of Productivity Promotion Centers nationwide was 2.241 billion yuan in 2019 and 2.325 billion yuan in 2020. In addition, the number of serviced companies has also been increasing yearly, reaching 176,122 in 2019 and 183,000 in 2020. The income of companies served by the centers increased from 77.5 billion yuan in 2019 to 229.5 billion yuan in 2020.

3.3 Technology Achievement Transformation Centers

(1) Scale of Development

Technology Achievement Transformation Centers are primarily organizations established by provincial and municipal science and technology departments, state-owned research organizations, universities, etc. According to statistics from the Zhongguancun Tianhe Technology Achievement Transformation Center, there are about 500 non-profit centers and institutions with similar functions (named "Technology Transfer Centers," "XX Design Institutes," "Technology Service Centers," etc.) in China.

Among them, about 100 with asset sizes in the 10 million yuan class are concentrated in universities and other research and development institutions. There are about 30 with assets of over 100 million yuan, located in top universities' affiliated research and development institutions, such as Tsinghua University's National Technology Transfer Center, and in economically and scientifically advanced regions like Beijing, Shanghai, and Guangzhou. They are mainly public platforms organized by provincial science and technology departments.

Most Technology Achievement Transformation Centers are small in asset size, with the main assets being human resources such as experts. Their staff numbers are also relatively low compared to the size of their assets. Coupled with the operation of the projects, most are consortiums of industrial, academic, and research organizations, so the number of fixed staff is relatively small, with centers with assets of 10 million yuan having only less than 40 staff.

(2) Regional Distribution

In general, the establishment of Technology Achievement Transformation Centers has been carried out in parallel with the establishment of the country's technology transfer system. Since 2013, a total of 11 national technology Transfer Regional Centers have been established nationwide with the approval of the Ministry of Science and Technology. These include the National Technology Transfer Agglomeration Area (Beijing), National Technology Transfer Southern Center (Shenzhen), National Technology Transfer Eastern Center (Shanghai), National Technology Transfer Central Center (Wuhan), National Technology Transfer Western Center (Chengdu), National Technology Transfer Northwestern Center (Xi'an), National Technology Transfer Northeastern Center (Changchun), National Technology

⁴⁴ Sanno (three rurals): Refers to agriculture, rural areas, and farmers.
Transfer Straits Center (Fuzhou), National Technology Transfer Suzhou South Center (Suzhou), National Technology Transfer Zhengzhou Center, and National Technology Transfer Marine Center (Qingdao).

Each technology transfer center's positioning and functions vary, but regional science and technology departments and research and development institutions, and new-type research and development institutions⁴⁵, integrate resources for the transformation of scientific and technological achievements according to the functional positioning of the transfer center, reorganize and construct the functions of technology transfer centers leveraging regional characteristics, and produce a nationally integrated layout.

(3) Revenue

Currently, many Technology Achievement Transformation Centers are non-profit institutions working for the public good. Therefore, budgets are arranged to balance annual revenue and expenditure in the final accounts according to the principle of financial balance.

3.4 Technology Property Right Exchange Organizations

(1) Scale of Development

According to the 2018-2023 China Intellectual Property Rights Transaction Organizations Development Model and Investment Strategy Planning Analysis Report ("2018-2023年中国产权交易机构发展模式与投资战略规划分析报告") published by the 前瞻 Industry Research Institute, China's technology intellectual property rights transaction market has developed over 34 years since the establishment of the first Technology Property Right Exchange Organization in Hubei Province in May 1988, developing from "nothing to something," "small to large scale," and "single to diverse."

There are about 300 Technology Property Right Exchange Organizations in China. Among them, institutions that primarily deal with technology intellectual property rights transactions include the China Technology Exchange in Beijing, Beijing Intellectual Property Rights Exchange Center, Shanxi Technology Property Rights Exchange, Henan Technology Property Rights Exchange, Jiangsu Technology Property Rights Exchange, Fujian High-tech Property Rights Exchange, Xi'an Technology Property Rights Exchange Center, and Ningxia Science and Technology Resources and Property Rights Exchange.

(2) Regional Distribution

In February 2022, the Ministry of Science and Technology Torch Center published the 2021 National Technology Contract Registration Situation Table ("2021年全国技术合同登记情况表") a list of nationwide technology contract trading data. According to the data, as of December 31, 2021, a total of 675,506 technology contracts were registered

⁴⁵ New-type research and development institutions ("新型研開机構"): Focus on the needs of scientific and technological innovation, mainly engage in scientific research or innovation, research and development services, and are independent corporations equipped with diversified investment subjects, modernized management systems, market-oriented operation mechanisms, and flexible employment mechanisms, able to legally register as non-enterprise organizations (organizations organized by enterprises, social organizations, or individuals that do not use national assets and conduct non-profit social service activities) or business organizations, or as companies. On September 12, 2019, the Ministry of Science and Technology issued the Guiding Opinions on Promoting the Development of New-Type Research and Development Institutions ("关于促进新型研发机构发展的指导意见"; http://www.gov.cn/gongbao/content/2020/content_5469722.htm).

using various regional Technology Property Right Exchange Organizations as the main platform, with a transaction volume of 3.729,43 trillion yuan, an increase of 22.1% and 32% respectively compared to the previous year.

The top 10 provinces and cities in terms of the transaction volume of technology contract certification registrations are Beijing, Guangdong, Jiangsu, Shanghai, Shandong, Shaanxi, Hubei, Zhejiang, Anhui, and Sichuan. According to the 2021 National Technology Flow Situation Table ("2021年全国技术流向情况表"), Guangdong Province, Beijing, and Jiangsu Province were the top three in terms of transaction volumes of incoming technology, with 420.978 billion yuan, 270.637 billion yuan, and 196.594 billion yuan respectively.

Notable Technology Property Right Exchange Organizations include Shanghai Technology Exchange ("上海技术交易所有限公司"), Wuxi City High-tech Property Rights Exchange Market ("无锡市高新技术产权交易市场有限公司"), and Jiangsu Yangtze River Delta Technology Property Exchange ("江苏长三角技术产权交易中心").

(3) Revenue

In 2022, the Ministry of Science and Technology provided notification of the 14th Five-Year Plan for the Special Plan of the Technology Factor Market ("'十四五'技术要素市场专项规划"). According to related statistics from this plan, by the end of the 13th Five-Year Plan in 2020, intermediary platforms centered around Technology Property Right Exchange Organizations facilitated a total of 549,400 technology contracts, with a transaction volume of 2.83 trillion yuan, which was 2.87 times that at the end of the 12th Five-Year Plan, recording an average annual growth rate of 23.49%. The average transaction volume of technology contracts increased from 3,202,500 yuan at the end of the 12th Five-Year Plan to 5,142,700 yuan, a nearly 10% average annual growth rate. The ratio of the transaction volume of technology contracts to GDP expanded smoothly from 1.43% at the end of the 12th Five-Year Plan to 2.79%, showing the expanding contribution of the technology market to economic development.

Innovation-driven transactions in technology markets are becoming more active, and companies continue to maintain their leading role in technology transactions as the largest source of innovation resources. In 2020, technologies dispatched by companies totaled 385,400, with a transaction volume of 2.58 trillion yuan, 3.05 times that at the end of the 12th Five-Year Plan, accounting for 91.4% of the national technology transaction volume. Technologies dispatched by universities and research institutions in 2020 totaled 143,900, with a transaction volume of 167.28 billion yuan, 1.91 times that at the end of the 12th Five-Year Plan.

3.5 Science and Technology Financial Service Organizations

(1) Scale of Development

In recent years, as Science and Technology Financial Service Organizations continue to grow, various social capitals have started to flood the market. However, in the government's drive for self-reliance and self-strengthening through innovation promotion as a basic national policy, the importance of government investment in science and technology for private startups has not diminished but has instead become increasingly significant.

In addition to traditional investment methods in science and technology, the government can provide strong financial support for the development of science and technology-type companies through a series of innovative

financial support methods such as innovation funds, incubation funds⁴⁶, guiding funds, transformation funds, and tax reduction and exemption policies.

Incubation funds are a source of funding for the government to create science and technology incubators, and since the main body of incubators in China is still the government, the role of the government in incubation funds, which financially support the development of science and technology finance in China, cannot be underestimated.

During the 12th Five-Year Plan period, the Ministry of Science and Technology issued a series of policy documents. Eventually, the concept of innovation and entrepreneurship permeated society, being effective in reversing the declining trend of incubation funds in China in 2011, and from 2012 onwards, the amount of investment in incubation funds has been increasing year by year. From 10.18 billion yuan in 2012 to 126.429 billion yuan in 2019, China's incubation funds increased by 11.42 times in just eight years, with an average annual growth rate of 43.32%.

The rapid expansion of incubation funds demonstrates the government's high interest and determination in the development of science and technology finance. Furthermore, government investment in incubation funds in the eastern region reached 94.105 billion yuan in 2019, accounting for over 74% of the national total of 126.429 billion yuan, indicating a regional imbalance where the eastern region is receiving more national financial input into incubators than the central and western regions.

(2) Regional Distribution

Currently, the scale of funding for science and technology innovation activities in China varies by region, with larger funding scales in economically developed regions such as Zhejiang and Jiangsu provinces, and smaller scales in relatively underdeveloped regions such as Yunnan, Hainan, and Xinjiang.

The Zero2IPO Research Center under the Zero2IPO Group has released a Chinese urban science and technology finance development index for three consecutive years. According to the 2021 index, Beijing, Shanghai, Shenzhen, Guangzhou, Hangzhou, Nanjing, Wuhan, Xi'an, Chengdu, and Tianjin were ranked in the top 10. In the process of the 2021 urban science and technology finance index survey, 30 cities were selected as subjects for investigation and evaluation, characterized by excellent policy environments, high potential for innovation and entrepreneurship services, active financial activities, and significant development in science and technology finance.

Examining the index, the development of science and technology finance is led by eastern cities, with central and western cities beginning to emerge. Beijing, Shanghai, and Shenzhen are not only financial centers but also hubs of science and technology innovation, making their development in science and technology finance significantly higher than other cities. Hangzhou, Guangzhou, Nanjing, Tianjin in the east, and Wuhan, Xi'an, Chengdu in the central and western regions are all important economic cities as well as science and technology innovation cities, and their development in science and technology finance are ranked in the top 10, but they are significantly behind Beijing, Shanghai, and Shenzhen. Xi'an moved up one place from the previous year, ranking eighth overall.

Major science and technology financial service institutions include Beijing Capital Science and Technology Development Group ("北京首都科技发展集团有限公司"), Hebei Science and Technology Investment Group ("河北 科技投资集团有限公司"), China Science and Technology Industry Investment Management ("中国科技产业投资管

⁴⁶ Incubation funds: A type of venture capital mainly used to invest in seed-stage projects with promising development prospects. They are government funds, used as operating funds for public incubators and as support and incentive payments to incubated companies.

理有限公司"), Beijing Legend Star Investment Management ("北京联想之星投资管理有限公司"), and others.

3.6 Patent Agencies

(1) Scale of Development

In recent years, the number of patent applications and the demand for agency services in China have rapidly expanded, and according to the National Intellectual Property Administration Development Situation (2021) document ("全国专利代理行业发展状况 (2021年)") compiled by the Intellectual Property Operation Promotion Department (Division) of the National Intellectual Property Administration, by the end of 2021, there were 3,934 patent agencies in China (excluding Hong Kong, Macao, and Taiwan) with 26,840 practicing patent agents, showing significant growth as an industry.

The scale of China's patent agency industry continues to expand. Since 2016, the number of patent agencies has been growing at an annual rate of over 20%, entering a phase of rapid growth. The number of practicing patent agents also increased by 15.7% in 2021 compared to 2020, maintaining a rapid growth trend. Nearly half of the practicing patent agents have over five years of practical experience.

As the patent agency industry continues to develop rapidly, the National Intellectual Property Administration conducted a thorough special rectification action called "Blue Sky" ("藍天")⁴⁷ in 2021, published a series of policy documents, cracked down on illegal agency activities, conducted hearings with 2,350 agencies, and issued corrective orders to 2,150 agencies to swiftly improve quality. It also imposed fines and warnings on 220 agencies and suspended or closed down 12 agencies showing a strong stance against illegal agency activities.

(2) Regional Distribution

According to the National Intellectual Property Administration Development Situation (2021), the geographical distribution of patent agencies shows comparatively large differences among provinces (autonomous regions, cities). Patent agencies are mainly located in Beijing, Guangdong, Jiangsu, Zhejiang, Shanghai, and other eastern and economically developed coastal regions, with the distribution of agencies generally matching the number of patent applications in each province (region, city). The top five provinces/cities in terms of the number of patent agencies are Beijing, Guangdong, Jiangsu, Zhejiang, and Shanghai.

Among them, Beijing has the highest number of patent agencies at 845, accounting for 21.6% of the total number nationwide. Guangdong ranks second with 634, accounting for 16.2% of the total. Jiangsu, Zhejiang, and Shanghai have 424, 286, and 265 agencies, respectively, accounting for 10.8%, 7.3%, and 6.7% of the total nationwide. Shandong, Sichuan, Anhui, and Henan have 174, 152, 136, and 106 agencies, respectively.

Examining the scale of patent agencies by the number of patent agents, out of the total 3,934 agencies, 3,356 have fewer than 10 patent agents, accounting for about 85.3% of the total. Among these, 1,104 agencies have fewer than 3 patent agents, 1,504 have 3 to 5, and 748 have 6 to 10. Agencies with 11 to 20 patent agents numbered 392, accounting for 10% of the total, an increase of 39 from 353 in 2020, but a decrease in percentage by 0.9%. Agencies with 21 to 50

⁴⁷ This special action aimed to crack down on illegal acts by patent agencies and strengthen and improve post-crack down supervision to promote the healthy development of the industry.

patent agents increased by 12 from 131 in 2020 to 143. There were 43 agencies with between 51 to 100 and more than 100 patent agents, mainly distributed in Beijing (33), Guangdong (7), Shanghai (2), and Jiangsu (1).

According to the 2022 National Intellectual Property Services Industry Statistical Survey Report ("2022年全国知识产权服务业统计调查报告") published by the National Intellectual Property Administration in December 2022, as of the end of 2021, about 928,000 people were employed in China's patent agency service industry. Of these, 63,369 had obtained patent agent qualifications, a 13.7% increase from the previous year. Practicing patent agents, as mentioned earlier, reached 26,840, a 15.7% increase from the previous year.

Major patent agencies include Unitalen Attorneys at Law ("北京集佳知识产权代理有限公司"), China Patent Agent (H.K.) ("中国专利代理(香港)有限公司"), and Beijing Wanhuida Intellectual Property ("北京万慧达知识产 权代理有限公司"), among others.

(3) Revenue

The business scope of patent agencies generally includes (1) support for patent-related tasks such as preparing application documents, handling procedures, and paying documents and fees, (2) consulting on related legal affairs, (3) patent searches, monitoring of patent expiration, (4) financing, transfer, and intermediary services for patent projects, (5) market research and feasibility report preparation for patent projects, (6) uncovering and eradicating counterfeit patents, preparation of litigation documents, (7) various appraisals for inventors, support for meetings, seminars, and project verification services. These services are provided for a fee and patent applicants must pay appropriately for them.

According to the 2022 National Intellectual Property Services Industry Statistical Survey Report, the total revenue of organizations involved in intellectual property services nationwide exceeded 260 billion yuan in 2021, an increase of 15.6% from the previous year. The total revenue of patent agencies was 43.75 billion yuan, with an average revenue of 11.113 million yuan. In 2021, the revenue per employee in the intellectual property services industry was 305,000 yuan, an increase of 17.1% from the previous year.

The total revenue of intellectual property service organizations in the Beijing-Tianjin-Hebei region, the Yangtze River Delta region, Guangdong-Hong Kong-Macau, and the Chengdu-Chongqing region amounted to about CNY214.77 billion, accounting for 82.6% of the national total. Among these, the average revenue of the intellectual property services industry in Beijing, Tianjin, and Hebei was CNY7.968 million, accounting for 30.6% of the national total.

3.7 Science and Technology Evaluation Organizations

(1) Scale of Development

According to the Zhongguancun Tianhe Science and Technology Achievement Transformation Center, it is understood within the industry that Science And Technology Evaluation Organizations have been established by government departments such as the Ministry of Science and Technology and the Ministry of Education, as well as the Chinese Academy of Sciences and in 27 provinces, cities, and autonomous regions, of which the number of provincial-level Science and Technology Evaluation Organizations is about 80, with a total of 3,500 professional evaluation staff.

In addition, universities, research and development institutions, think tanks, academic societies, associations, and consulting companies also conduct science and technology evaluations. The introduction of third-party evaluations through the State Council's supervision and inspection in 2014 has led to third-party evaluation organizations

emerging one after another. However, at present, a unified entry mechanism for the science and technology evaluation industry has not been established, and the qualifications of evaluation organizations, the quality of evaluation staff, and evaluation methods and standards are still in the exploratory stage.

(2) Regional Distribution

Science and Technology Evaluation Organizations are mainly concentrated in relatively economically and technologically developed regions such as Beijing, the Yangtze River Delta, and the Pearl River Delta, while the central and western regions and the northeast are still in the learning and exploration stage.

Even in some regions where Science and Technology Evaluation Organizations are relatively developed, they show different characteristics depending on the features of regional development and the level and scale of technology achievement transformations.

Major science and technology evaluation organizations include Guangdong Science and Technology Evaluation Center ("广东省科技评估中心"), Jiangsu Science and Technology Evaluation Center ("江苏省科技评估中心"), Liaoning Technology and Economy Evaluation Center ("辽宁技术经济评估中心"), Zhejiang Science and Technology Evaluation and Achievement Transformation Center ("浙江省科技评估和成果转化中心"), and others.

3.8 Science and Technology Information Service Organizations

(1) Scale of Development

According to a survey conducted by the Zhongguancun Tianhe Science and Technology Achievement Transformation Center on the Beijing Municipal Science and Technology Information Center, by 2020, the market size of the science and technology information services industry in China had reached about 160 billion yuan, and the trend in recent years indicates that the industry's growth has become more stable and favorable. With the government's increased support for science and technology-type enterprises, the number of Science and Technology Information Service Organizations has also increased, and related investments have surged.

In 2022, the investment scale of China's science and technology information services industry is expected to reach about 45 billion yuan. The number of Science and Technology Information Service Organizations in China was 2,429 as of 2020, an increase of 142 from 2018. The newly added information service organizations are mainly institutions established by large group companies for use within the group.

Examining the content of information research, studies on the development of the science and technology industry are the most numerous, followed by research on trends in science and technology development (21%), forecasts of science and technology development (15%), tracking of science and technology development (12%), studies on science and technology policies (10%), and strategies for science and technology development (6%). Government departments are the largest target for the information research services of Science and Technology Information Service Organizations.

(2) Regional Distribution

According to information from the Beijing Municipal Science and Technology Information Center, the regional distribution of demand for the science and technology information industry is 29.6% in East China, 10.8% in Central China, 20.6% in South China, 18.61% in North China, 4.89% in the Northeast, and 15.5% in the West. In 1956,

China's first Science and Technology Information Service Organization (now the Institute of Scientific and Technical Information of China) was established, and subsequently, Science and Technology Information Service Organizations were established in various provinces one after another. From 1958 to 1960, provincial-level Science and Technology Information Service Organizations were intensively established, with 21 institutions established in three years, accounting for two-thirds of the current provincial-level information organizations. Furthermore, in 1973, Qinghai, Beijing, and Tianjin established information research institutes, and in the following two years, science and technology information research institutes in Ningxia and Xinjiang were established, essentially leading to the formation of the provincial-level Science and Technology Information Service Organizations.

Novelty investigation in science and technology is both a traditional service and an important business of Science and Technology Information Service Organizations. Currently, there are 38 national first-level ranked science and technology checking and innovation consulting organizations in China, 19 of which are provincial-level Science and Technology Information Service Organizations. In the networked market-oriented economic environment, science and technology novelty investigation research activities have also found new areas of growth, and these services are mostly maintained and developed by local Science and Technology Information Service Organizations.

Major science and technology information service organizations include the Institute of Scientific and Technical Information of China ("中国科学技术信息研究所"), Beijing Municipal Science and Technology Information Research Institute ("北京市科学技术情报研究所"), Zhejiang Provincial Science and Technology Information Research Academy ("浙江省科技信息研究院"), Guangdong Institute of Scientific & Technical Information ("广东省科学技术情报研究所"), and others.

(3) Revenue

According to information from the Beijing Municipal Science and Technology Information Center, in 2021, the sales of the science and technology information services industry in China amounted to about 150 billion yuan, but overall revenue was not high due to the prevalence of public organizations. Among the expenditures of business organization-type Science and Technology Information Service Organizations, costs involved with collecting, organizing, and processing science and technology information are the highest, accounting for about 80% of total costs. In addition, expenditures on social security, employment, health, and housing support also occupy a relatively high proportion of costs.

4 Operation Methods, Characteristics, Successes, and Challenges of Typical STIAs

We conducted a survey on Science and Technology Intermediary Agents representative of China and compiled the results. The following content is based on the responses of each Agent.

4.1 Incubators

4.1.1 Beijing Beihang Tianhui Technology Incubator Co., Ltd. ("北京北航天汇科技孵化 器有限公司")

(1) Organizational Structure and Overview

Beijing Beihang Tianhui Technology Incubator Co., Ltd. (Beihang Incubator) is the first enterprise-type science and technology specialist incubator and a national-level high-tech enterprise in Beijing. It was established jointly by the Beijing Municipal Science and Technology Commission and Beihang University. It was registered and established in Haidian District, Beijing, on April 12, 1999.

Around 1995, the Haidian Science and Technology Industrial Zone, centered on Zhongguancun, naturally formed in the Beijing area. Subsequently, the Beijing Municipal Government positioned the development of the hightech industry as a crucial strategic measure for regional economic development, launched a series of policies to support the development of the high-tech industry, and the government's departments with jurisdiction over science and technology allocated special budgets and established incubators, supporting technological innovation and the cultivation of science and technology-type small and medium-sized enterprises.

Beihang Incubator expanded its operations in phases starting from the industrialization of research findings of the Beihang New Material High-Tech Incubator⁴⁸ to enterprise incubation, cultivation of entrepreneurs, and the introduction of venture capital, specializing in various fields beyond new materials, including electronics, machinery, communications, computer networks, and more. With the diversification of incubation models and the expansion of specialized fields, Beihang Incubator must possess a clear position, qualify to participate in market economy activities, and obtain stable incubation funds to maintain normal operations.

However, the incubator at the time was dependent on the university's school-run enterprises⁴⁹, it was not an independent corporation. Meanwhile, the incubator's startup capital depended on one-time government funding, and the incubator needed to develop funding channels to maintain long-term incubation activities. In other words, it had to accumulate a certain level of incubation funds through commercialization and seek growth through waves of

⁴⁸ The Beihang New Material High-Tech Incubator was jointly established by the Beijing Municipal Science and Technology Commission and Beihang University in 1997 to promote the transformation of scientific and technological achievements from the university and surrounding universities, cultivate and grow science and technology-type enterprises, and aim to cultivate and create technology entrepreneurs.

⁴⁹ School-run enterprises: Businesses established or managed by universities for profit.

development.

Therefore, continuing to depend on the school-run enterprises would not meet the development needs of the incubator itself. For the sustainable development of Beihang Incubator, it is essential to build a corporate system with clear property rights and responsibilities, a market-oriented operating mechanism, a scientifically standardized internal organizational management system, and corresponding incentive mechanisms in a timely manner.

Beihang Incubator receives startup capital from the Beijing Municipal Government, as well as technical, talent, and infrastructure support from the university. After the establishment as a limited liability company, the board of directors is composed of personnel appointed by business organizations under the Beijing Municipal Science and Technology Commission and enterprises affiliated with Beihang University.

(2) Cooperative Relationships

Currently, Beihang Incubator adopts a three-party management model and is deepening collaboration with stakeholders. These parties include BUAA Science Park ("北航大学科技园"), Beihang Incubator, and Beijing Overseas Students Entrepreneurship Park) ("北京留学人员创业园") (hereinafter referred to as "Entrepreneurship Park"). On December 27, 2000, Beihang University established the BUAA Science Park, which became the top-level management organization of Beihang Incubator.

In March 2003, the Entrepreneurship Park was officially established, jointly launched by Beihang University and the Zhongguancun Science and Technology Park Management Committee. The BUAA Science Park Construction and Development Center is responsible for implementing the Entrepreneurship Park, and Beihang Incubator is responsible for its daily management. This management approach not only maximizes the use of the advantages of Beihang University's scientific and technological resources, enhancing the speed and efficiency of transforming scientific research achievements, but also allows the incubator and companies within the Entrepreneurship Park to quickly feedback their technological needs and achievements to the university.

The establishment and operation of Entrepreneurship Park utilizes the incubation experience and resources of Beihang Incubator. The Entrepreneurship Park not only centralizes the planning and operation of venture companies by returned overseas students within the incubator but also gathers many resources for returned overseas students' venture companies through its professional service orientation, expanding the customer base of the incubator.

(3) Achievements and Areas of Expertise

Beihang Incubator focuses on the transformation of scientific and technological achievements and the incubation of technology projects in fields such as next-generation information technology, AI, VR/AR, and smart manufacturing. The current management service team consists of 24 people, including 2 senior technical positions, 8 with master's degrees, and 3 returned overseas students. Twelve of these individuals have a background in industry or experience in entrepreneurship, investment and financing, supply chain management, or corporate management. On May 19, 2022, Beihang Incubator was selected as the third of Beijing's 2022 "Specialized, Fine, Unique, and Innovative"⁵⁰ small and medium-sized enterprises.

⁵⁰ Specialized, Fine, Unique, and Innovative: Refers to accelerating the specialization, refinement, uniqueness, and innovation level of small and medium-sized enterprises.

Since its establishment, Beihang Incubator has continued to explore innovation and service level upgrades, cultivating more than 1,200 high-tech companies and 19 well-known listed companies, creating an average of 2,679 jobs over the past three years, 80% of which are high-growth science and technology innovation companies established within five years, with 151 companies in next-generation information technology fields such as natural language processing (NLP), digital economy, and VR/AR. Furthermore, 42 companies are in smart manufacturing fields, such as wearable devices, display screens, and medical equipment, and an incubation success rate of over 90% has been achieved.

(4) Success Stories

(1) Jet Pulverizer Project

Jet pulverizers are widely applied in industries such as chemical engineering, electronics, plastics, ceramics, pharmaceuticals, food, and daily-use chemicals, with rapidly growing domestic and foreign demand. They have a relatively bright market outlook. The first project Beihang Incubator undertook was co-investing 500,000 yuan to construct a pilot production line with an annual processing capacity of 50 tons.

After completing the pilot line, the production line received ongoing business, achieving financial balance. Several companies have now expressed their intention to provide funding for purchasing this pilot line. At the time of participating in the project, the incubator had not yet established a standard corporate structure. The investors were the incubator, and financial management was conducted by the school-run enterprise attached to the incubator, with the main technical staff being university teachers and others.

(2) Civil Remote-Controlled Airship

The civil remote-controlled airship project integrates Global Positioning Technology (GPS), Geographic Information System (GIS), and modern communication technologies (GSM), promising a wide range of applications in aerial advertising, aerial photography, video shooting, aerial surveillance, scientific exploration, urban planning, communication relay, power line erection, and forest fire prevention. The core technical staff of this project were young teachers from Beihang University who were interested in starting high-tech companies but could not due to a lack of funds and business management experience.

At that time, Beihang Incubator had become a formal limited company, and both parties had agreed on the following conditions: Specifically, Beihang Incubator would provide part of the capital, offer necessary support such as financial management, and the developers would contribute technology and capital to conduct business activities independently. They agreed to distribute profits according to each party's share of investment in the form of simulated shares, clarifying the investment ratios of Beihang University (intangible assets), Beihang Incubator, and the developers. In other words, in the initial stages of the product, it operated within Beihang Incubator as a quasi-company model. When conditions such as the product and market were ready, a limited liability company was established with Beihang Incubator, Beihang University, and the developers as shareholders.

Since the property rights and responsibilities of all parties were clearly distinguished, a clear agreement was obtained for the future development of the project, relieving the developers' anxieties, increasing motivation, and allowing them to become regular employees of the incubator. They continued to improve the product and develop the market, achieving a profit of more than 200,000 yuan within that year. Moreover, the developers received training in the process of bringing a product to the market, gradually growing into multifaceted talents who understand technology, management, and marketing. Currently, the project has reached maturity, and the establishment of a

limited liability company by the three parties is on the agenda.

(3) GPS & GSM Technology Integration Application Project

The GPS National Key Laboratory at Beihang University was the first organization in China to begin research and development on integrated application products combining GPS and GSM technologies. It is a leading presence in China in applications that merge the latest GSM digital cellular mobile communication technology with GIS geographic information systems and computer network technology.

Beihang Incubator invested 300,000 yuan to establish a GPS series product division. Seven months after incubation, it had developed a series of products such as vehicle monitoring and dispatch, and theft prevention systems, moved from principal prototypes in the laboratory to small batch production, found customers, won orders, and developed market routes.

The product attracted an investment of 1 million dollars from an external company to purchase the technology and establish a limited liability company. At the early stage of the project's incubation, Beihang Incubator reached an agreement with Beihang University regarding the handling of the university's intangible assets and agreed to reflect the university's interests through shareholding via Beihang Incubator. A postdoctoral researcher from Beihang University, who is the leader of this project, received training in product development and market exploration and is currently in charge of technology, products, and marketing in the newly established company, with strong aspirations to grow as an entrepreneur.

(5) International Cooperation

Beihang Incubator is currently expanding international cooperation jointly with cooperation organizations and platforms such as Zhongguancun International Incubator and the International Cooperation Department of Beihang University. Zhongguancun International Incubator is a professional platform providing comprehensive services for returned overseas students and Chinese entrepreneurs, aiming to achieve an internationalization and digitalization chain. Since its establishment, it has attracted over 800 international talents to start businesses in China, incubating over 800 companies that they started. In total, the 140 incubated companies have received over 3 billion yuan in investments, leading to the gradual establishment of an effective incubation operation system for international high-end science and technology talents.

With the support of Zhongguancun International Incubator, Beihang Incubator has set up overseas liaison offices in countries and regions such as the United States, the United Kingdom, Israel, and Canada, building a global resource network, actively introducing overseas high-tech resources, and providing one-stop incubation services for overseas entrepreneurship projects.

Beihang Incubator participates in the Beijing Belt and Road International Incubation Federation (ICI) with the support of the Zhongguancun High-Tech Industry Park. ICI aims to share innovation and entrepreneurship resources between Beijing and countries along this "Belt and Road," seeking a new cooperative incubation and cross-border model for mutual benefits and results. Through ICI, Beihang Incubator has successfully introduced outstanding incubation projects from Israel and the United States in many strategic emerging industries such as ICT, intelligent hardware, robotics, high-end equipment, and digital technology.

(6) Challenges and Development Goals

Corporate operation and market-oriented evaluation mechanisms are one future direction. In a market economy, it is

difficult to maintain operations without stable funding, and although the government and universities invest one-time funds in incubators, limited startup capital and subsequent fundraising challenges put incubators in a difficult position. Even with stable funding sources, it is challenging for all types of incubators to effectively carry out their operations without a solid management system and operating mechanism. Beihang Incubator is committed to strengthening its reform efforts, adhering to corporate operation and market-oriented evaluation mechanisms in the future.

1. Enrichment of Incubation Services with Multiple Levels and Diverse Models

The forms of technology-based startups vary, and the situations and needs of incubation targets differ. Some entrepreneurs have already established companies, while others have projects but not the conditions to establish a company. Some companies need comprehensive incubation, while others only require certain levels of support.

Therefore, it is not rational to adopt simple and fixed incubation standards or use the same incubation model for different incubation projects. Effectively supporting technology entrepreneurs, promoting the growth of small and medium-sized technology companies, and effectively developing the incubator itself can only be achieved by specifically combining the characteristics of projects in the selection of incubation targets, determination of incubation models, and operation of incubation projects.

Beihang Incubator has achieved results by adopting this guideline for the selection and operation of incubation projects. In the future, it plans to compile project experiences and form a regular operation model for future exploration.

2. Enhancing Fundraising and Investment Operation Capabilities

Generally, incubators act as intermediaries between technology entrepreneurs and venture capitalists, on the one hand preparing conditions for incubated companies to access venture capital, and on the other creating a favorable venture capital environment for investors. While few incubators directly engage in venture capital activities, the flexible mechanism of corporate-type incubators allows them to conduct small-scale venture capital activities directly linked to incubated projects.

Through initial venture investments, Beihang Incubator deepened its understanding of incubation projects, and narrowed the distance between its own interests and investment projects, thereby increasing the success rate of incubation and the potential for investment returns for both parties. The crucial aspect of venture capital investment by incubators is the incubator's own fundraising and investment operation capabilities, both of which significantly influence future development.

4.1.2 Tianjin Zhihui Valley Technology Service Co., Ltd.

(1) Organizational Structure and Overview

Established in October 2017, Tianjin Zhihui Valley Technology Service Co., Ltd. (Tianjin Zhihui), a wholly owned subsidiary of iFLYTEK Co., Ltd., has a registered capital of 217 million yuan. Located in the Tianjin Airport Economic Area, it bases itself on the Tianjin Industrial Acceleration Center, jointly established by iFLYTEK and Tianjin Port Free Trade Zone, adopting an innovative operating model of government-corporate cooperation and official support for private operation to actively promote innovation, entrepreneurship, and incubation in the artificial intelligence industry.

The Tianjin Industrial Acceleration Center officially opened in May 2018. The base covers an area of 20,010 square meters, with a building area of 31,000 square meters. It has achieved honors and qualifications such as Manufacturing

Industry Double Innovation Platform Pilot Demonstration (Ministry of Industry and Information Technology), Innovation Characteristic Carrier (Ministry of Industry and Information Technology, Ministry of Science and Technology, Ministry of Finance), Tianjin Group Innovation Space, and a Space Distinguished by Numerous Scholars. Amid the strong support and development of Tianjin's smart science and technology industry, the Tianjin Industrial Acceleration Center provides the potential of AI to AI companies and traditional industries in the Beijing-Tianjin-Hebei region, newly contributing to the development of Tianjin's smart science and technology industrial ecosystem⁵¹.

Tianjin Zhihui aims to attract innovation and entrepreneurship to Tianjin by utilizing the Tianjin Industrial Acceleration Center. The goal is to produce a significant AI online and offline incubation platform in Beijing, Tianjin, Hebei, and further in Northern China, gradually forming an AI industry ecosystem while promoting the important role of AI in improving people's lives, transforming and upgrading traditional industries, and supporting Tianjin to reach the heights of the national and global AI industry.

Tianjin Zhihui has established the Tianjin Zhihui Valley Artificial Intelligence Experience Center focusing on iFLYTEK's technology and products in smart education, smart healthcare, smart justice, smart homes, smart cities, and other areas. It is gathering companies and startup teams in the field of artificial intelligence to conduct various industrial activities.

To promote the incubation and growth of science and technology-type companies, especially in artificial intelligence, it provides services such as rent benefits, government publicity, media publicity, market resources, human resources, finance, taxation, legal consultations, management consulting, investment, training, technical support, talent recruitment and retention, policy declarations, technological cooperation with universities, achievement transformation, intellectual property rights, and more.

Its technical support mainly enables technical exchanges with millions of developer teams through the hundreds of AI products and functions on iFLYTEK's open platform.

In the field of venture capital fundraising, companies with funding needs can gain priority recommendation qualifications for industry guidance funds operated in cooperation with the government by the Acceleration Center, as well as direct investments by iFLYTEK. Moreover, according to industrial development, center construction, and companies' special needs, Tianjin Zhihui submits policy requests to local governments to seek targeted policy support.

(2) Cooperative Relationships

Tianjin Zhihui primarily cooperates with platforms and incubation partners such as iFLYTEK Venture Capital, Business Partner Program, THE MAKER CAMP (創客営), etc., pioneering integration with and application of the incubation industry chain for science and technology-type companies, especially in the field of artificial intelligence.

iFLYTEK Venture Capital, adhering to the investment philosophy of Industry + Technology + Capital, is a powerful industrial investment platform specializing in investments in the fields of intelligent technology and innovation. It promotes the core competitiveness of project parties and realizes the project's added value, thereby supporting accelerated market expansion. This is performed against the backdrop of iFLYTEK's strong AI technology and industrial resources, rich entrepreneurial experience, and capital advantage.

⁵¹ The concept of the industrial ecosystem has been built by comparing the metabolic processes and structures and functions of ecosystems, especially the movement of materials and energy, with industrial activities and their impacts on natural systems.

The Business Partner Program is an essential tool for Tianjin Zhihui to seize development opportunities in the field of science and technology services during the 14th Five-Year Plan period. It is a significant force for realizing Tianjin Zhihui's large-scale industrialization, and an important part of iFLYTEK's strategic development.

Through Creator Camp, Tianjin Zhihui consolidates resources available on its cloud platform to build an online communication platform and assess the value of future collaborations with open resources. At each periodic exchange meeting, it recruits six excellent venture companies in industries such as smart education, digitalization of enterprises, smart industry, smart cities, etc., for online exchanges with entrepreneurship mentors and investment institutions, efficiently and quickly assessing companies' needs and providing support by opening up excellent resources.

Additionally, Creator Camp serves as a platform that can comprehensively support incubated companies and science and technology-type companies and entrepreneurs with services such as advertising and branding, incubation and business investment services, taxation and financial services, human resources services, legal services, design and construction services, IT support, and more.

Its partnership with UCOMMUNE (Beijing) Venture Investment started in 2021, allowing direct access to dozens of famous domestic investment institutions, including Sequoia Capital China Fund and ZhenFund. Office spaces for incubated companies are provided through UCOMMUNE in 49 cities, including in China and Singapore.

(3) Achievements and Areas of Expertise

Tianjin Zhihui provides a science and technology service platform that supports not only capital matching with investee companies but also technology, resources, training systems, and business promotion.

Unlike traditional incubators, Tianjin Zhihui relies on iFLYTEK's world-leading AI digital and intelligent technology, integrates with industry leaders to support industry transformation and upgrade, and provides AI technology to entrepreneurs and small and medium enterprises free of charge. By combining iFLYTEK's AI technology with their own situations, entrepreneurs and small and medium enterprises can develop their products.

Tianjin Zhihui not only provides technology but also opens up the supply chain to certified startup companies, dividing orders from large enterprises and distributing them to various micro and small/medium enterprises. The company operates one of the national four major open innovation platforms: iFLYTEK AI Open Platform, continuously providing AI development and service functions to mobile internet and smart hardware startup developers and many users, actively building an industry ecosystem centered around the platform.

By the end of 2022, it had released 118 AI products and functions, gathering over 700 developer teams, with the total number of applications exceeding 550,000, cultivating more than 250 incubated companies, and creating 10,000 jobs. The cumulative output value of incubated companies exceeded 12.5 billion yuan. In 2021, it was certified as a national-level incubator⁵² by the Ministry of Science and Technology.

(4) Success Stories

(1) QiZhi Science and Technology

QiZhi Science and Technology (Beijing) was established through the iFLYTEK Venture Capital platform operated by

⁵² National-level Incubator: Refers to an incubator that conforms to the provisions of the "Management Measures for Science and Technology Enterprise Incubators" ("科技企业孵化器管理办法") and is certified by the Ministry of Science and Technology. According to the 2022 National Economic and Social Development Statistical Bulletin, as of the end of 2022, there were 1425 national-level incubators.

Tianjin Zhihui, integrating the advantages of iFLYTEK's information and service ecosystem to build an AI technology company. QiZhi uses a deep learning-based semantic understanding engine based on the optimization of iFLYTEK's semantic understanding engine.

Through incubation support from Tianjin Zhihui, the company was the first in the industry to launch a service function that matches music and story resources with legitimate copyrights. This function supports data customization for tens of thousands of Q&A libraries. Additionally, Tianjin Zhihui applied iFLYTEK's leading AI human-computer interaction technology, perception technology, and cognitive computing technology to QiZhi's product development, resulting in the development of robots, AI modules, and an AI cognitive cloud with proprietary intellectual property rights.

Through Tianjin Zhihui's open and win-win cooperation concept, QiZhi has created various artificial intelligence products and services applied to intelligent rearview mirrors, nursing robot solutions, wearable devices, and intelligent small home appliance solutions by combining partners' technology, scenarios, and equipment.

(2) 維格智数科技

Shenzhen Weige Zhishu Technology (深圳維格智数科技) is one of the projects incubated and operated through Tianjin Zhihui's Business Partner Program platform. The core product of Shenzhen Weige Zhishu Technology, VIKA (維格表)⁵³ is an API (Application Programming Interface)-oriented data table, which can be used to assemble tools through a simple data partnership system and used in a building block-style project management system. The product's research, development, and applications were supported by many organizations participating in the Business Partner Program, including iFLYTEK, Tencent, and Baidu. Tianjin Zhihui was also involved in the investment and initial operation.

(5) International Cooperation

Tianjin Zhihui's international cooperation is primarily advanced through the international site of iFLYTEK's open platform. iFLYTEK's open platform international site already covers regions such as Singapore, Japan, Thailand, the Philippines, Vietnam, Malaysia, etc., providing advanced AI technology, capabilities, and one-stop solutions to realize globalization strategies relating to AI technology mainly for domestic companies expanding overseas, foreign companies, government agencies, and developers. The provided technologies include core technologies such as speech synthesis/recognition, and machine translation, and business areas such as smart education, smart healthcare, enterprise digitalization, smart cities, AI marketing, etc. Tianjin Zhihui, characterized by iFLYTEK's technology support branch in the fields of healthcare and enterprise digitalization, is actively expanding investments in these fields.

Since 2020, in line with its head company's development strategy, it has actively promoted cooperation with countries along the belt and road. As the implementing entity, in November 2020, Tianjin Zhihui, together with iFLYTEK and the Malaysia Digital Economy Corporation, signed a memorandum to jointly establish an AI Innovation Center at an appropriate future opportunity. The Malaysia Digital Economy Corporation will provide policy support for the establishment of the AI Innovation Center until 2024, and the Malaysian government, iFLYTEK, and Tianjin

⁵³ 維格表: A next-generation team data collaboration and project management tool developed by 深圳維格智数科技有限公司. It is applicable to business scenarios such as project management, data collaboration, customer management, content management, etc., supporting the improvement of digital productivity for small and medium enterprises.

Zhihui plan to regularly promote visits, exchanges, and cooperation on research and other themes. At the same time, the Malaysia Digital Economy Corporation, belonging to an ASEAN member state, also plans to actively recommend the deployment of Tianjin Zhihui's AI projects in ASEAN countries.

(6) Challenges and Development Goals

(1) Improving specialized capabilities to meet needs and solve problems

There is a need to enhance specialized service capabilities for responding to customer needs and solving problems. According to customer feedback, some staff members lack professionalism in the actual service process for companies, with services being unsophisticated and basic. Services are surface level with low problem-solving efficiency, and the needs of companies during incubation are not being met. The main reason for these issues is the lack of professionalism and experience among team staff.

Tianjin Zhihui, established by iFLYTEK to realize the transformation of scientific and technological achievements, has a relatively young team that was composed over the four years since its establishment, with a low percentage of staff certified as incubator practitioners⁵⁴. The team lacks comprehensive business knowledge and practical experience and is limited in its ability to guide companies. Additionally, the incubator's training system has not been improved, and there is no training plan for managing the company employees. Training is often conducted through pre-employment preparatory training and regular study sessions, with the instructors generally being managers from the company, making it difficult to systematically achieve improvements in the professionalism of the management team.

According to regular surveys conducted by the company for its customers, incubated companies are particularly dissatisfied with "information provision regarding related government policies and regulations, the provision of advisory services on policy, business, and law," and "the provision of counseling on entrepreneurship and training on technology, marketing, and management skills."

As organizations that nurture startup companies, providing accurate and effective entrepreneurship guidance services is vital for an incubator. However, the company needs to enhance its effectiveness in this area. Currently, it regularly conducts training activities such as creator salons and entrepreneurship diagnostics, but the format of these activities remains on-the-spot lectures by mentors, without follow-up or guidance on the training after the activities, leading to relatively short-lived benefits.

The incubator currently mainly invites university professors and corporate personnel for one-time lectures, lacking a continuous guidance system or a specific incentive or subsidy system for entrepreneurship mentors, making it difficult to gather leading experts to play a long-term role as mentors or advisors. Additionally, there is no evaluation system for entrepreneurship mentors, with some focusing solely on completing tasks without prioritizing actual results.

(2) Insufficient value-added services

Finally, incubated companies' overall satisfaction with the value-added services provided by the incubator is low, and information obtained from the operators of the incubator and preliminary hearings has revealed the following issues.

Currently, amongst the incubator's value-added services, there are only a few that are useful for businesses, such as

⁵⁴ Incubator practitioner certification: A type of qualification certification created to solidly implement the Science and Technology Business Incubator Management Measures ("科技企业孵化器认定和管理办法") aimed at strengthening the training of incubator practitioners and improving the business level and service capability of incubator management.

assistance in drafting business plans or strategic plans, providing external network resources, matching services for investment and financing, and promoting exchange and cooperation among companies within the incubator, and they have not been highly rated. Firstly, as related to objective and subjective factors of corporate development, the overall plan and development path for value-added services are not yet fully clear, and the demand for value-added services by incubated companies and the potential revenue brought by the development of value-added services have not been appropriately rationalized, leading to a relatively small number of resources being invested in value-added services.

Currently, the incubator's primary revenue comes from basic services such as land leasing, intermediary services, consulting services, training services, and some policy subsidies and support funds, with a relatively simple revenue model. Incubated companies are unable to develop routes to access investment, financing, and research resources from universities, delaying service model innovation and failing to accurately provide services to incubated companies. Support from the Tianjin Municipal People's Government and iFLYTEK's policy and institutional environment is necessary for Tianjin Zhihui to develop higher value-added services.

4.2 Productivity Promotion Centers

4.2.1 Shandong Productivity Promotion Center (山东生产力促进中心)

(1) Organizational Structure and Overview

The Shandong Productivity Promotion Center, originating from the Weihai City Science and Technology Information Research Institute and jointly operated by the central government's Ministry of Science and Technology, Shandong Department of Science and Technology, and Weihai Municipal Government, is the first productivity promotion center in mainland China, established in June 1993. Its registered capital is 2 million yuan. The center aims to enhance regional economic competitiveness through professional services, promoting more efficient innovation and resource utilization. In 1997, it was certified by the Ministry of Science and Technology as a national-level productivity promotion center. It provides one-stop science and technology intermediary services to governments, universities, research institutes, companies, and industrial parks.

The center consists of a technology consulting department, management consulting department, e-commerce department, international cooperation department, information resource department, and education and training department. The technology consulting department offers consulting services for obtaining certifications for ISO9001 quality management systems, ISO14000 environmental management systems, OHSAS18000 occupational health and safety management systems. It organizes various technology exhibitions, fairs, and seminars, promotes the dissemination of common technologies and mature industrial projects such as CAD and CIMS, tackles research challenges in an organized manner, and solves technical problems for companies.

The management consulting department gathers resources of management experts to provide companies with consulting services on development strategies, diagnostic consulting, marketing planning, etc. Specifically, it assists in creating business plans for corporate project development, applying for national plans, small and medium-sized enterprise innovation funds, high-tech enterprise certifications, etc. Management practice seminars and workshops are also provided.

The e-commerce department is responsible for the construction and daily maintenance and management of network equipment for websites such as the Weihai Information Network, Shandong Agricultural Information Network, Weihai Science and Technology Bureau Network, and China-Japan-Korea Science and Technology Economic Cooperation Network. It is also responsible for the construction of the information data resources of the Management Center and is also in charge of designing image advertisements.

The international cooperation department provides services such as overseas inspection surveys and training, scientific and technological trade, and cooperation negotiations for attracting investment. It strengthens scientific and technological exchanges and cooperation with South Korea, Italy, Japan, Hong Kong, Macao, Taiwan, and other countries and regions, and supports the development of international markets for enterprises.

The information resource department provides consulting, design, and training services in network engineering. It offers domain name application and webpage production services. With its national-level novelty investigation qualifications, it can launch scientific and technological projects, conduct novelty checks of scientific and technological achievements, provide search services, and promote the spread of sales software systems.

The education and training department sets up training courses on various common technologies and modern management, and conducts training on foreign languages, internet knowledge, and ongoing education for professionals and technicians.

The center is building a more comprehensive national innovation service network, focusing on services for enterprises, especially small and medium-sized enterprises, and plays an important role in various aspects such as technology consulting, achievement transformation, technical training, incubation, and science and technology finance. The center has built a service network in 17 cities in Shandong Province and has 76 staff members. Among them, 23 are high-end specialized service personnel, such as masters, PhDs, and senior engineers. In collaboration with over 10,000 renowned experts and scholars, it has established the Shandong Torch Science and Technology Think Tank ("山东火炬科技智") and the National Patent Navigation Team ("专利导航国家队").

Since the 13th Five-Year Plan period (2016-2020), the center has made significant contributions to the promotion of the development of high-tech industries in Shandong Province and the cultivation of innovators, as well as organizing talent, conducting enterprise consulting, career counseling, industrial park consultations, mass entrepreneurship ("mass entrepreneurship" or "mass innovation") and mass innovation (collectively referred to as "double innovation"), performing achievement evaluations, and providing innovation/entrepreneurship services throughout the province.

During the 13th Five-Year Plan period, it conducted over 100 lectures and training sessions on various science and technology policies, provided services to over 10,000 small and medium-sized enterprises, over 100 incubated companies, and over 50 industrial parks, nurturing many high-tech companies, incubated companies, and high-tech industrial parks. It has also promoted the healthy three-level linkage mechanism (between province-city-county) of the Productivity Promotion Centers, facilitating the deep development of mass entrepreneurship and innovation in Shandong Province and increasingly strengthening its influence in the field of science and technology services.

(2) Cooperative Relationships

The center has signed cooperation agreements with over 2006 universities and research and development institutions domestically and internationally. In addition, it has also signed cooperation agreements with over 8776 experts. The center has established long-term cooperative relationships with Technology Property Right Exchange Organizations in Beijing, Tianjin, and Shanghai, and Productivity Promotion Centers in Hong Kong and Taiwan, as well as various venture capitals, financial firms, and legal consulting firms, providing cross-regional, cross-field, and cross-industry innovation services.

It also cooperates with local city-level Productivity Promotion Centers and has built and operated regional platforms such as the Beijing-Tianjin-Hebei (Shandong Province) Integrated Science and Technology Service Platform, the Central Regional City Cluster Integrated Science and Technology Service Platform Research and Development and Application Demonstration Project (a 2018 Ministry of Science and Technology application demonstration project), the Shandong Peninsula National Independent Innovation Demonstration Zone Service System Construction Project, and the Shandong Yellow Sea Technology Market.

The center has taken over the administrative management tasks transferred from the related departments of the Shandong Department of Science and Technology, becoming an important supporter of the science and technology departments of the Department of Science and Technology and others. In this role, it mainly performs policy research and consulting for provincial government policymaking. This includes policy planning and theoretical research, science and technology policy consulting, consulting on the formulation of science and technology plans, science and technology statistics and analysis, regional innovation system research, industry development research, development models, and evaluation system research.

The center's management services for science and technology programs includes the acceptance of notifications of science and technology projects from the national, provincial, and municipal levels, reviews of science and technology projects, bidding for science and technology projects, the acceptance, review, supervision, and verification of innovation fund projects for science and technology-type small and medium-sized enterprises at the national and Shandong provincial levels, and the review of research and development expense deduction projects for companies within Shandong Province. In terms of policy promotion and explanation activities, the center's work includes declarations and certification of high-tech enterprises, the evaluation of science and technology-type small and medium-sized enterprises, the declaration of innovation funds, and related policies on science and technology finance.

Since 2018, under the commission of the Shandong Department of Science and Technology, it has undertaken open sharing of state-owned research facilities and equipment within the province, the review and declaration of innovation vouchers⁵⁵, and has provided science and technology assurance services to suppliers, small and micro enterprises, and startup teams. As part of its platforms, the center publishes information on the supply and demand of research infrastructure and research equipment resources for high-tech parks and small and medium-sized enterprises across the province, simplifies procedures through online reservation processing, and improves the efficiency and quality of services for small and medium-sized enterprises and startup teams.

The center also subsidizes the costs incurred by small and micro enterprises and entrepreneurial teams in the province for conducting test, experiment, and analysis activities related to science and technology innovation, when they use the research facilities and instruments of universities, research and development institutions, and other business organizations, by applying for the provincial innovation voucher.

(3) Achievements and Areas of Expertise

According to the center's internal statistics, since its establishment, it has provided a total of 16,168 consultations on

⁵⁵ Innovation voucher ("創新券"): Certificates of interest issued by the government to science and technology-type small and mediumsized enterprises and innovation startup teams free of charge, primarily to encourage them to fully utilize the resources of innovation service providers such as universities and research and development institutions for research and development activities and technological innovation, and to serve as collateral for loans.

management and technology, 4,650 technical services including technology development, popularization, and product testing, and supplied 8.77 million pieces of information. The center has introduced 1,097 technologies, recruited 4,382 talents, organized 299 technology transaction activities, and supported and nurtured 907 science and technology-type small and medium-sized enterprises. Out of these, 297 companies have completed their incubation and graduated. The total number of companies that have received various services from the center now numbers 23,210.

The center pays close attention to national and provincial policies on mass entrepreneurship and innovation (double innovation) and the actual development of the region, actively engages in contact and guidance work with incubation agents such as incubators, group innovation spaces, university science and technology parks, and mass entrepreneurship and innovation demonstration bases. In addition, it is energetically expanding customized high-value-added services such as project diagnosis, startup counseling, startup training, and achievement transformation, continuously improves its service level as an incubation agent, has created numerous high-level institutions with unique and innovative models, and actively promotes the construction of an incubation system referred to as a "group innovation space-incubator-accelerator" to support the development of startup companies.

Leveraging the province's experience and strengths in mass entrepreneurship and innovation, it actively carries out activities in these areas. With the cooperation of the provincial academy of sciences, Shandong University, and other universities and research and development institutions, as well as the Productivity Promotion Centers in Jinan, Zibo, Rizhao, and other places, it continuously conducts a variety of mass entrepreneurship and innovation activities such as innovation lectures, creator contests, forums, salons, and mass entrepreneurship and innovation activity weeks. It thereby promotes comprehensive and multi-level relevant science and technology services for startup companies and works to build a favorable development environment for innovation and entrepreneurship.

During the 13th Five-Year Plan period, the center organized and implemented more than 50 key research projects at the provincial level, including the construction of industrial park science and technology achievement transformation zone service platforms, regional information platforms for science and technology achievement transformation, and integrated service platforms for science and technology consulting. Additionally, it published nearly 40 papers in academic journals, assisted companies in obtaining more than 103 software copyrights, formulated nearly 10 regional and industry standards, participated in drafting numerous science and technology innovation policies, and made dozens of decision-making recommendations to the government.

(4) Success Stories

(1) Beijing-Tianjin-Hebei-Shandong New and Old Kinetic Energy Conversion⁵⁶ Comprehensive Science and Technology Service Platform

In 2018, with the support of the Shandong Provincial Department of Science and Technology and the Dezhou Municipal People's Government, the Shandong Productivity Promotion Center and the Dezhou Economic and Technological Development Zone in Shandong Province jointly established the "Beijing-Tianjin-Hebei-Shandong New and Old Kinetic Energy Conversion Comprehensive Science and Technology Service Platform" in the Dezhou Science and Technology Innovation Entrepreneurship Park. The platform is jointly operated by the Shandong Productivity

⁵⁶ New and old kinetic energy conversion: A concept in development economics, referring to the replacement of old models with new ones, transforming old industries into new industries, old technologies into new technologies, and old materials and energy into new materials and energy.

Promotion Center and the Dezhou Economic and Technological Development Zone, with the Dezhou Municipal Government bearing all the establishment costs, while the Shandong Productivity Promotion Center bears the operational costs. The development zone attracts and introduces companies to participate in the platform, but the staff at the Shandong Productivity Promotion Center handle the specific business operations of the platform in a concurrent capacity.

Additionally, the platform is positioned as a third-party integrated science and technology service platform that operates based on the public interest, openness, and a market orientation. The platform has built a comprehensive science and technology service system integrating "government, industry, academia, research, finance, service, and users" (seven-in-one) providing services to enterprises in ten key areas such as talent recruitment and training, research and development, intellectual property rights, technology transfer, science and technology finance, science and technology consulting, incubation, testing and inspection, high-tech enterprise cultivation, and brand building. This supports the transformation and upgrade of traditional industries and guides the development of emerging industries, enhancing the core competitiveness of enterprises and supporting the implementation of the significant strategic project of new and old kinetic energy conversion in Shandong Province.

The platform provides one-stop comprehensive science and technology services to enterprises, universities, and research institutes as carriers of innovation, nurturing the regional science and technology service industry. The platform integrates high-quality science and technology service resources from Beijing, Tianjin, Hebei, and Shandong, adopts the internet + science and technology services model, closely connects enterprises with high-level experts and scholars, supports enterprise innovation, and can provide comprehensive services such as online consulting.

The platform spans 1,800 square meters through an offline integrated service hall. The hall is divided into seven areas including intellectual property rights, technology transfer, science and technology finance, science and technology consulting, testing and inspection, financial and tax consulting, and project investment promotion campaigns. This platform can accommodate all 47 kinds of service organizations, with 32 companies already contracted.

(2) Shandong Yellow Sea Technology Market

Jointly constructed by the Rizhao Department of Science and Technology, Rizhao High-Tech Park⁵⁷, and Shandong Productivity Promotion Center, the market was established and opened on December 28, 2017, with the approval of the Shandong Department of Science and Technology, becoming an important part of the Shandong Yellow Sea Science and Technology Innovation Research Institute. The Shandong Yellow Sea Technology Market is characterized as a public welfare, open, market-oriented third-party professional science and technology comprehensive service platform. The Rizhao Department of Science and Technology and Rizhao High-Tech Park are government agencies that do not engage in specific business, so all operations are handled by the Shandong Productivity Promotion Center.

It adopts a combination of online and offline, constructing an online science and technology data platform, technology achievement transaction platform, technology contract registration platform, science and technology financial services platform, technology agent platform, science and technology achievement database, professional

⁵⁷ High-tech Park: A high-tech (industrial development) park refers to a science and technology industrial park authorized by governments at all levels, designated for high-tech development, relying on a knowledge-intensive, technology-intensive, open environment, which gathers and learns from overseas advanced scientific and technological resources, funds, management methods, and maximally transforms scientific and technological achievements into actual productivity through tax incentives, financing policies, and various reform measures, combining scientific research, education, and production.

talent pool, and patent pool. It also works with Shandong Province Science and Technology Achievement Transformation Service Platform, integrating the science and technology innovation resources of universities, research and development institutions, and enterprises both inside and outside the city. Offline, focusing on the Rizhao High-tech Park, it has set up technology achievement transformation and transaction service counters, bringing in science and technology service organizations such as patent navigation standardization, scientific and technological achievement evaluation, testing, inspection, etc., and deploys technology transfer and transformation services throughout the city.

Shandong Yellow Sea Technology Market, as a member of the Shandong Technology Transfer Alliance, shares significant scientific and technological achievements within the province, collecting data on 4,000 major scientific and technological achievement projects through the provincial science and technology achievement transformation service platform and university research organizations. It closely cooperates with Beijing Guozhi Patent Warning Consulting, and Shandong Torch Knowledge Industry and Transportation Co., Ltd., to provide enterprises in Rizhao City with intellectual property services such as patent agency, standardization, analysis, early warning, operation, etc., by accumulating over 50,000 patents in its patent pool, of which the total technology contract amount reached 1.23 billion yuan in 2018.

(3) Establishment of Shandong Peninsula National Independent Innovation Demonstration Zone

Shandong Productivity Promotion Center, under the guidance of the provincial Department of Science and Technology, formulated the establishment plan for the Shandong Peninsula National Independent Innovation Demonstration Zone, applying for the establishment of the demonstration zone with Jinan, Zibo, Weifang, Qingdao, Yantai, and Weihai's six high-tech parks (hereafter collectively referred to as Shandong Peninsula National High-Tech Parks) as the main body. In September 2014, the provincial government formally submitted the document prepared by the center to the State Council for application for the Zone's establishment. In December 2014, the executive meeting of the State Council listed the demonstration zone as one of the national independent innovation demonstration zones to receive focused support. In August 2015, the Ministry of Science and Technology conducted a re-investigation of the construction program together with the National Development and Reform Commission, Ministry of Education, Ministry of Industry and Information Technology, Ministry of Finance, Ministry of Housing and Urban-Rural Development, Ministry of Land and Resources, etc., and proposed a revised plan.

The center improved the plan based on the opinions of all parties, making the construction program more scientific and reasonable. On April 5, 2016, the State Council issued a document formally approving the construction of the Shandong Peninsula National Independent Innovation Demonstration Zone.

The construction plan submitted by the center to the State Council pointed out that "Shandong Peninsula has important scientific and technological innovation platforms such as the Qingdao National Laboratory for Marine Science and Technology, contains more than 50% of the national marine research and development institutions and 70% of the national high-end marine talents. The scientific research achievements in Shandong Peninsula include independent research and development of marine monitoring devices, marine drilling platforms, marine biopharmaceuticals, and other high-tech products, and brings significant benefits to China." The demonstration zone is the only one among the existing demonstration zones that is strategically positioned as a national demonstration zone, fully realizing the role of the six national high-tech parks within it and integrating the science and technology innovation resources of the Shandong Peninsula region.

Based on more than three years of basic field surveys, the center made a proposal regarding the significance of

constructing the demonstration zone. It aims to develop the Shandong Peninsula High-Tech Parks to be on par with national high-tech parks such as Zhongguancun in Beijing, Zhangjiang in Shanghai, East Lake in Wuhan, etc. Based on its domestic and international experience in transforming technology achievements, the center proposed that the demonstration zone should receive various preferential policies.

(5) International Cooperation

The center actively promotes international cooperation based on the "Opinions on Further Developing International Science and Technology Cooperation" ("关于深入开展国际科技合作的意见") issued by the provincial science and technology department. The center's concept of cooperation is based on the new situation surrounding global scientific and technological development, planning innovation from an international perspective, effectively gathering international innovation resources, and achieving high-quality development.

The center has built a bridgehead for Chinese-Japanese-Korean scientific and technology innovation cooperation based in Weihai, cooperating with the Weihai municipal government and the provincial Department of Science and Technology. It takes advantage of its geographical proximity to Japan and South Korea, implementing cooperation mechanisms such as with the science and technology sector of Incheon, South Korea, and through the Shandong-Incheon Regional Economic Cooperation Joint Committee Science and Technology Subcommittee, promoting the construction of innovation cooperation platforms such as the Chinese-Korean Science and Technology Innovation Park, Chinese-Japanese (Weihai) Technology Transfer Center, etc. The center is establishing Chinese-Japanese-Korean scientific and technology cooperation working groups, organizing technology transfer and innovation cooperation matchmaking, innovation competitions, etc., collecting together Chinese-Japanese-Korean scientific and technology innovation resources, and enhancing Shandong Province's scientific and technology innovation capability in fields such as marine biology, electronic information, new materials, etc.

It is also actively expanding cooperation for innovation with countries along the Belt and Road. The center conducts high-level, multifaceted, and extensive innovation dialogues with government departments, research and development institutions, renowned universities, and enterprises of the countries along the route, continuously expanding scientific and technology cooperation, and playing a leading role in the construction of the Belt and Road.

It is deepening cooperation with advanced Western countries in fields such as smart manufacturing, electronic information, high-end equipment, life sciences, medical devices, etc., and expanding cooperation with Russia, Ukraine, and other former CIS countries in fields such as marine science and technology, new materials, etc. It supports municipal-level science and technology departments within the province to cooperate with countries such as Israel, Australia, Hungary, etc., in fields such as biomedicine, health care and rehabilitation, modern agriculture, etc.

(6) Challenges and Development Goals

Currently, the center's main development challenges are as follows.

1. Comprehensive service capability has not kept up with actual progress

In recent years, enterprises have increased their demands on Science and Technology Intermediary Agents, but the center currently lacks common technologies and core technologies that could guide enterprises. Its comprehensive capabilities in science and technology financial services, industrial upgrading, intellectual property rights, etc., are not strong, it has failed to form a core business and core competitiveness, the capability of the service team is clearly insufficient, and it is not able to meet the growing needs of enterprises. In terms of service means, its optimization

work of service processes through internet+, big data, and the internet of things has just begun, and it is not able to meet the specialized and diversified service needs of enterprises.

2. Lack of personnel with comprehensive skills and high-level talent

A considerable number of the center's staff have not received professional training, and lack knowledge and experience in management consulting, technology consulting, and business operation. It particularly lacks staff with a combined knowledge of markets, technology, management, law, etc. In addition, the center has not yet established a policy system or environment for talent cultivation, recruitment, or incentives, making it difficult to attract personnel, secure high-level talent, and secure high-quality resources for cooperation. Its shortage of staff with professional knowledge has become a serious impediment to its development.

3. Lack of understanding of innovation

As a key hub of science and technology intermediary services in the province, the center is important to the technology market for disseminating innovation, and its role spans the entire course of innovation dissemination. However, the center still lacks the strong communication, coordination, and integration capabilities required in the process of disseminating innovation, and an awareness of integrating these into its innovation efforts. Due to a limited understanding of innovation, the majority of the center's work remains focused on traditional technology intermediation roles, serving as bridges or links. However, as socio-economic development progresses, these functions fall significantly short of meeting the innovative development needs of the technology market.

Going forward, as a provincial-level Science and Technology Intermediary Agent, the center requires talent in both technical and managerial fields. Due to the nature of the center's work, building a team of talented individuals should be its core focus. As such, efforts are being made to actively recruit talent, improve staff composition, encourage the participation of individuals with overseas experience and senior experts at the center, provide support in terms of policy and funding, and offer material guarantees for work and living conditions to outstanding examples of talent.

At the same time, more government support measures need to be explored in the future. Many of the devices and equipment provided by the center to enterprises have been modified by experts from the in-house research and development center by applying their specialized knowledge and practical experience. While these modifications are practical, there are aspects where the level of specialization is still lacking. Therefore, it is necessary to enhance funding and policy support for the research and development center. It must actively seek support and nurturing from the government.

4.2.2 Jiangsu Productivity Promotion Center (江苏省生产力促进中心)

(1) Organizational Structure and Overview

The Jiangsu Productivity Promotion Center is a deputy bureau-level Science and Technology Intermediary Agent directly under the Jiangsu Department of Science and Technology. It was first established in 1992. After several reorganizations, it now encompasses the Jiangsu Productivity Promotion Center, Jiangsu Science and Technology Exchange Center with Foreign Countries, and Jiangsu Province Physical and Chemical Testing Center under one roof, possessing three independent brands and one team. The Jiangsu Productivity Promotion Center consists of 20 departments including a science and technology achievements supervision and evaluation room, innovation management & high-tech services department, industrial planning & civil-military integration innovation service department, regional innovation service department, science and technology project acceptance & review department,

science and technology project management department, multinational technology transfer center, science and technology resource development & technology transfer department, innovation platform management & service department, science and technology financial services department, high-level personnel & foreign expert services department, low-carbon technology service center, science and technology talent training center, enterprise consultation & intellectual property rights service center, physical & chemical testing service center, rural science and technology service center, enterprise development services center, enterprise and technology service center, physical & chemical testing service center, rural science and technology service center, services center, enterprise and technology service center, physical & chemical testing service center, rural science and technology service center, services center, enterprise consultation & intellectual property rights service center, physical & chemical testing service center, rural science and technology service center, industrial big data & software development services center, etc.

Its science and technology service space is nearly 20,000 square meters wide and equipped with more than 50 pieces of advanced large-scale scientific equipment and facilities. It has 241 personnel, with specialized technicians holding a master's degree or above accounting for 80% of staff. Additionally, 80% hold intermediate or higher professional titles, 76 hold senior titles, 1 young expert has made outstanding contributions in the province, and 18 have been selected for the third level of Jiangsu Province's high-level personnel training project. Its main services include project management services for science and technology programs, management services, for the Sunan Autonomous Innovation Zone, technology financial services, enterprise consulting, science and technology talent training, science and technology intellectual property rights, enterprise benchmarking analysis, testing, inspection, etc. It is accredited by the Ministry of Science and Technology as a national-level demonstrative productivity promotion center⁵⁸ and a national technology transfer demonstration institution⁵⁹.

The center focuses on three objectives: building a brand business, enhancing science and technology service capabilities, and building a talent team. It provides detailed science and technology management support services to the government, and specialized science and technology services to industries and enterprises.

(2) Cooperative Relationships

As the specialized agency for the management of provincial science and technology plan projects, entrusted by the provincial Department of Science and Technology, it handles the declaration, acceptance, and review of various science and technology plan projects, provides corresponding management services, conducts on-site supervision and inspection, project tracking management services, project file collection for Jiangsu Province science and technology achievement transformation special fund projects, and undertakes management services such as evaluation and supervision of projects commissioned by third parties. Specifically, its business relationship with the government is as follows.

1. Centralized acceptance and examination & evaluation of the forms of various provincial-level science and technology plan projects and professional technical qualification information of the natural sciences in the province

⁵⁸ In 2011, the Ministry of Science and Technology issued "National-level Demonstrative Productivity Promotion Center Accreditation Management Measures" based on the Small and Medium-sized Enterprises Promotion Law to improve the networking of the service systems of productivity promotion centers and promote their specialization, large scale expansion, and standardization. If the conditions specified in these measures (such as the quality assurance system) are met, it will be accredited as a national-level demonstrative productivity promotion center.

⁵⁹ In 2007, the National Ministry of Science and Technology issued Management Measures for National Technology Transfer Demonstration Institutions to standardize technology transfer organizations. If the conditions specified in these measures are met, it will be accredited as a national technology transfer demonstration institution.

- 2. Construction and maintenance of a provincial science and technology plan project management information system and provincial science and technology consultant database
- 3. Online procedures and management services for contract conclusion, intermediate inspection, project acceptance, etc., of provincial-level science and technology plan projects
- 4. Management services for the entire process when the provincial Department of Science and Technology makes policy decisions or performs macro-management, including management, process management, onsite supervision services, project acceptance, etc., of the provincial science and technology achievement transformation special fund project
- 5. Management services for the accreditation of high-tech enterprises at critical points such as acceptance of declarations, evaluation, name change, system maintenance, etc.
- 6. Management services for provincial science and technology awards, enterprise innovation awards, international cooperation awards, etc.
- 7. Evaluation and review services for science and technology projects, talent, and awards, entrusted by provincial and local government departments at all levels
- 8. Conducting training on science and technology policy and project management-related tasks

It is actively exploring collaboration with universities and various research and development institutions. The center has signed cooperation agreements with major scientific and educational organizations such as the Chinese Academy of Sciences, Peking University, Tsinghua University, Zhejiang University, etc., to jointly promote the introduction of innovation resources. Its tasks include the construction and management of new-type research and development institutions within the province, statistical monitoring, and services for improving quality and efficiency. Currently, the operation and maintenance of Jiangsu Province's industry-university-research cooperation intelligent service platform and the construction services for local platform layouts are handled by the center's industrial big data and software development department. Its science and technology resource development & technology transfer department is responsible for promoting the construction of technology transfer centers and core institutions of science and technology services in universities throughout the province and managing the Jiangsu Technology Transfer Alliance.

The center has a very close relationship with enterprises, and its science and technology financial services department has started providing technology consultation and technology transfer services for enterprises. It has also established the Jiangsu Science and Technology Enterprise Financing Route Research Service Center, offering one-stop, specialized, and customized science and technology financial services such as technology guarantees, stock investments, IPO consultations, and loan consultations for science and technology-type enterprises for free. Additionally, it provides low-threshold, low-interest, and efficient customized financial services for high-tech enterprises.

Currently, the center focuses on providing science and technology innovation and achievement transformation services for companies in various industrial parks.

The center selects science and technology personnel to be stationed in industrial parks, directly assigning them at the forefront of innovation, and together with the science and technology department of the industrial park management committee, creates an online service platform, compiling a list of science and technology services centered on technology transfer, science and technology financing, testing and inspection, talent recruitment, science and technology consulting, science and technology training, etc., timely meeting the needs of the carriers of innovation.

(3) Achievements and Areas of Expertise

The strength of the Jiangsu Productivity Promotion Center lies in its ability to provide comprehensive and one-stop services to all types of companies within industrial parks, as well as specialized services such as low-carbon and physical and chemical testing.

The center currently has cooperative relationships with 58 industrial parks within Jiangsu Province. This includes 21 national-level high-tech parks, 21 provincial-level high-tech parks, and 16 other industrial parks, fully covering all the high-tech parks within the province. Regionally, there are 41 industrial parks in southern Jiangsu Province, 5 in central Jiangsu, and 12 in northern Jiangsu. It focuses on services to the Sunan Autonomous Innovation Zone while covering industrial parks in central and northern Jiangsu, essentially providing services across the entire province. In 2016, the center formed the Jiangsu Science and Technology Innovation Service Federation, actively playing the role of a leader in the province's science and technology service industry.

Since 2021, the center has been focusing on the two decarbonization goals of peak carbon and carbon neutrality.

1. It is actively participating in the province's actions to meet these goals.

The center actively collects and aggregates information on peak carbon and carbon neutrality, conducts research and learns from science and technology departments and policies from other provinces, holds seminars and discussions with experts within the province, and cooperates with the provincial people's congress representatives and the provincial development and reform committee to conduct research activities on these areas.

2. Scientific Support for the Green Development of High-Tech Parks

The center conducts research and surveys aimed at the green development of high-tech parks within the province, providing support for over 10 industrial parks such as Jiangyin Hi-Tech Industrial Development Zone, Yancheng National High-tech Industrial Development Zone, and Taizhou Modern Pharmaceutical High Tech Industrial Park, etc., in creating five-year action plans for green development, building green and low-carbon technology innovation systems focusing on major industries and high energy-consuming sectors within the industrial parks, enhancing the innovation capacity and core technology development and supply capacity in green and low-carbon frontier technologies, and strengthening and supplementing the chains of leading companies in green development within the industrial parks, supporting the achievement of the two decarbonization goals.

3. Upgrade of Green Service Capabilities

The center actively visits industrial parks (enterprises) to promote national and provincial green development-related policies centered around the management goals for energy consumption and pollutant emission restrictions set by the Development and Reform Commission, and departments such as industry and information technology, environmental protection, etc., pushing forward green management and creation in industrial parks. Specialized staff are deployed to provide consulting in the green sector, assisting industrial parks such as Baima High-Tech Park and Xiangcheng High-Tech Park in ensuring the creation of regional energy evaluation implementation plans and the establishment of green parks.

4. Active Links to Low-Carbon Research Positions

The center strengthens exchanges and visits with low-carbon research platforms within the province, integrating the province's scientific research strength in the green field, and supporting the achievement of the region's two decarbonization goals from a scientific and technological perspective. The center visited the Jiangsu Academy of Agricultural Sciences to conduct research and development and demonstration exchanges on carbon sequestration and emission reduction technologies for agriculture. It exchanged views with the Jiangsu Environmental Science Research

Institute on joint implementation routes for pollution reduction and carbon reduction in the region.

Furthermore, under the guidance of the provincial Department of Science and Technology, the center leverages the advantages of science, education, and industry within the province, cooperating in the implementation of special projects for scientific and technological innovation in decarbonization, promoting five projects related to the demonstration of key core technologies and advanced application technologies, construction of major scientific and technological platforms, green development of high-tech parks, and open innovation cooperation related to decarbonization. It also accelerates the formation of a market-oriented green and low-carbon technology innovation system, providing strong scientific and technical services to support the achievement of the two decarbonization goals in a timely manner.

(4) Success Stories

(1) Enterprise Innovation Score System

In 2020, as a form of powerful support to achieve self-reliance and self-strengthening and realize high-quality development the Ministry of Science and Technology Torch Center initiated a trial enterprise innovation score system⁶⁰ project. To accelerate the spread and application of this new technology evaluation tool in innovation parks, timely identify high-growth scientific and technological innovation enterprises, scientifically evaluate and nurture them, and accelerate the aggregation of various factors of innovation in enterprises, the advanced manufacturing and energy-saving environmental protection department at the Jiangsu Productivity Promotion Center, based on its existing operations and combining regional characteristics of Jiangsu Province, developed an enterprise innovation score information system platform and applied it in several innovation parks.

The center has further improved the scoring system and evaluation methods according to the characteristics of industrial parks, expanding the core indicators to about 30 characteristic indicators, optimizing the structure of the score indicator system, and enhancing systematic, scientific, and comprehensive evaluations.

Currently, this system has been authorized to receive a computer software copyright and was successfully implemented and applied in Wuxi and Zhenjiang. The system initially registered over 300 science and technology-type enterprises in the database, scientifically determining their innovation situation through comparative analysis of innovation input and output, combining it with the innovation policy system of industrial parks, and conducting scientific diagnoses for the healthy and sustainable growth of enterprises through the targeted introduction of innovation resources such as scientific and technology awards, subsidies, financial loans, and professional talents. In addition, the Jiangsu version of the enterprise innovation score evaluation system evaluates the current situation and potential for green development amongst enterprises based on their industry and development stage characteristics, from the aspects of resource and energy consumption, pollution, and greenhouse gas emissions, objectively evaluating the quality of their development.

The center has introduced quantitative, trackable, and publicly available statistical monitoring evaluations of carbon emissions and related green indicators into the score indicator system, forming a comprehensive and complete evaluation indicator system, and supporting industrial parks in achieving the two decarbonization goals. To establish

⁶⁰ The system quantitatively evaluates the capability of enterprises to innovate, accurately identifying high-innovation capacity and highgrowth potential technology enterprises, effectively uncovering them, and enhancing the credibility of high-scoring companies.

and disseminate the scoring system, the center has developed an enterprise innovation score information system platform, further enhancing its efficiency of reporting, collecting, reviewing, comprehensively analyzing and optimizing innovation data and clarifying the quality of innovation within companies in industrial parks through comparisons of multiple score indicators. This helped overcome the difficulties in implementing the score and significantly improved the convenience of statistical analysis when operating the system.

(2) Express Service⁶¹ for the Biopharmaceutical Industry's Science and Technology Financial Services

The first "station" of the Express Service for the Biopharmaceutical Industry's Science and Technology Financial Services initiated by the Jiangsu Productivity Promotion Center was in Taicang City, Jiangsu Province. The financial services network has been gradually built up to cover the entire province, constantly gathering financial resources for the forefront of scientific and technological innovation from four angles: platform construction, product creation, service provision, and emphasis on cultivation.

Additionally, the center launched the Ke e Rong (科e融) brand for customized science and technology financial services, starting science and technology financial services such as Jiangsu Province Science and Technology Enterprise Financing and Investment Promotion Service Center and a direct service for high-tech enterprise financing, etc., within the province, serving over 30,000 companies in the past decade and supporting fundraising of more than 130 billion yuan for science and technology-type enterprises.

In recent years, to further leverage the role of science and technology finance and to resolve difficulties and strengthen the industrial chain, the center collaborated with the Shanghai Pudong Development Bank to launch a special action called the Biopharmaceutical Industry Science and Technology Finance Express Service. Its aim is to further expand the financing channels for biopharmaceutical companies and support the rapid development of the biopharmaceutical industry.

For its express service action, a product for pharmaceutical financing was designed specifically for biopharmaceutical companies. It is characterized by its low threshold, low interest rates, high credit limit, high efficiency, and long term nature, being designed to ensure biopharmaceutical companies can receive high-quality and efficient financial services. For the early implementation of the express service action, the center collaborated with the Taicang City Science and Technology Bureau and Shanghai Pudong Development Bank to conduct policy promotion, targeted visits, and discussions with nearly 300 biopharmaceutical companies to understand their funding needs and lending intentions and created lending credit solutions for some companies. During the event period, the Suzhou branch of Pudong Development Bank provided loans to six companies, totaling 283 million yuan.

(3) Jiangsu-Shaanxi Industry-University-Research Cooperation

In 2022, the Jiangsu Productivity Promotion Center (Xi'an) Innovation Service Station and the Jiangyin City High-Tech Park (Xi'an) Innovation Center opened in Xi'an to further implement the technology transfer plan, accelerate the transfer and transformation of scientific and technological achievements, and promote further cooperation among industry, universities, and research institutions in Jiangsu and Shaanxi provinces.

⁶¹ Express Service ("直通車"): Refers to simplifying procedures for the early commercialization of scientific and technological achievements. Normally, the process of applying for commercialization financing for technological achievements goes: evaluation of the technological products by financial institutions → internal procedures by financial institutions→ loan approval. However, in the case of express service financing, for example, when applying for commercialization financing for a biopharmaceutical technology achievement through the Jiangsu Productivity Promotion Center's platform, a special team consisting of the center and cooperating financial institutions reviews the loan application, if there are no issues, approves it.

Shaanxi province has rich scientific and educational resources, with 98 universities and many high-level higher education and research and development institutions. In particular, Xi'an Jiaotong University, a key university directly under the Ministry of Education that was selected as a double first-class university⁶², has 8 disciplines included in the first-class disciplines. Furthermore, by leading the construction of the China Western Innovation Port and the Shaanxi University Technology Transfer Alliance, it has refreshed the model of industry-university-research cooperation, playing a role in supporting the economic and social development of the region.

This station was jointly constructed by Jiangsu Productivity Promotion Center, Jiangyin National High-Tech Park, and Xi'an Jiaotong University National Technology Transfer Center. It is the first of Jiangsu Productivity Promotion Center's innovation service organizations to be located outside the province and represents a new model of close scientific and technological exchange and industry-academia-research cooperation between Jiangsu and Shaanxi.

The station plans to promote Jiangsu Province's science and technology talent policy, announce the innovation needs of Jiangsu Province's high-tech parks and companies, organize technology investment promotion campaigns online and offline, conduct research and development tours from remote locations and visits to industrial parks in Jiangsu Province by universities in Xi'an, and hold technology transfer symposiums, etc.

Furthermore, the center will explore mechanisms of talent exchange with local universities and R&D institutions, promote the systematic integration of western innovation resources, and strengthen the innovation collaboration between industrial parks and companies in Jiangsu Province and Shaanxi Province. Additionally, it will accelerate the transformation and application of innovation achievements, providing strong scientific and technological service support for the development of scientific and technological innovation in Jiangsu Province and Shaanxi Province.

(5) International Cooperation

The center's international cooperation business is managed by the Center of International Technology Transfer. The center acts as a bridge to overseas institutions, including 63 institutions such as the California Energy Commission and the Royal Institute of Technology in Sweden.

The Jiangsu Belt and Road Alliance for Collaborative Innovation & Technology Transfer, established by the Jiangsu Productivity Promotion Center, has built close cooperative relationships with 28 countries and regions along the Belt and Road, carried out over 50 science and technology cooperation projects, and established over 30 innovation carriers such as joint laboratories and overseas incubators. Moving forward, the alliance will make further efforts towards producing results from innovation cooperation achievements among the Belt and Road countries, expand the Belt and Road innovation cooperation friendship zone, establish a professional science and technology service team, and build the alliance's service brand through science and technology innovation-led cooperation in international production capacity.

⁶² The Chinese government has been implementing two plans, the "211 Project" and the "985 Project," aimed at building world-class universities. The 211 Project designated 116 key universities and 1000 key disciplines. The 985 Project selected 39 universities from the 116 universities of the 211 Project to further accelerate the construction of advanced new disciplines. Both projects were succeeded by the double first-class (world-class universities and first-class disciplines) project. In this project, 42 universities for building world-class universities and 140 universities for building first-class disciplines were selected (including the aforementioned 42 universities) in the first cycle, announced in 2017. On February 9, 2022, 428 disciplines from 147 universities were selected as the second cycle of the double first-class construction universities and disciplines. Of the 147 universities selected in the second cycle, seven new universities (eight disciplines) were selected, and the remaining 140 universities were continued from the first cycle.

(6) Challenges and Development Goals

(1) Improvements to the mechanism for science and technology finance

The center assists in raising over 20 billion yuan annually for about 4000 science and technology-type small and medium-sized enterprises in the province. However, compared to the 100,000+ science and technology-type companies in the province, the number of companies served is still quite limited, indicating a need to further strengthen the scale and impact of science and technology financial services.

Innovation in both science and technology innovation and finance is essential, and departments responsible for these areas should regularly conduct promotions and consultations on science and technology financial activities, jointly refreshing their science and technology financial services and solving the financing problems of science and technology-type companies. However, Jiangsu Province has not yet established a coordination department or guidance group for special science and technology finance businesses, lacks an inter-departmental coordination mechanism, and has not established a provincial-level science and technology finance association or alliance, making it difficult for the center to promote science and technology finance, resulting in limited effectiveness and impact.

(2) A need for enhanced market awareness

Currently, over 80% of the projects operated by the center rely on government support, with the main source of business being government-provided projects. Therefore, it lacks the capacity for sustainable development and market competitiveness. As a result, compared to the business of advanced technology service companies in Beijing, Shanghai, Shenzhen, etc., the center's business is more monotonous. Most of its business primarily involves providing technology services and information consulting. Outside of industrial parks, it lacks distinctive advantages or regional features linked to local economic development, leading to dysfunction and an inability to fully leverage the social value of science and technology intermediary services.

(3) Lack of joint development

Joint development is crucial for the Productivity Promotion Center to expand its development scale. However, due to its nature as a business organization, it lacks market-oriented functions, leading to an unhealthy mechanism for profit distribution with cooperative organizations within the center, and an inability to build a good joint supply relationship between institutions. Furthermore, the center is hesitant to share resources with other institutions due to concerns over intellectual property rights and confidentiality in technology, resulting in not fully leveraging synergistic effects and benefits even when involved in synergistic business. These are future technological and institutional challenges for the center.

4.3 Technology Achievement Transformation Centers

4.3.1 Beijing Gaoke Qichuang Technology Achievement Transformation Service Platform ("北京高科启创科技成果转化服务平台")

(1) Organizational Structure and Overview

This service platform was established in 2002 with a registered capital of 1 million yuan and a staff of 51 people. It is a high-tech company in Beijing established by the Beijing Municipal Government, providing one-stop services for high-tech achievement transformation projects. It is a fully funded business organization directly under the municipal Science and Technology Commission.

It provides specialized services such as policy decision consulting, professional training, technology transfer, financing support, and information exchange to government departments, enterprises, and business organizations, bridging the demand and supply of science and technology achievement transformation between universities, R&D institutions, and companies in Beijing. The service platform is particularly responsible for the reception, organization, evaluation, and publication of the city's high-tech achievement transformation projects, coordinating the related policies of high-tech achievement transformation projects supported by the municipal government.

As a public Science and Technology Intermediary Agent, it has a relatively high degree of business concentration, abundant science and technology resources, and flawless service functions, serving as an important platform for deepening the reform of the science and technology system and achieving innovation-driven development, meeting the needs of various recipients of science and technology services.

By 2021, it had received approximately 23,000 consulting and visit requests from companies, accepted 1688 hightech achievement transformation projects applied for by companies and performed expert evaluation and review. After the review and determination by the city's high-tech achievement transformation project certification group, a total of 965 achievement transformation projects were certified, including 162 large projects of over 5 million yuan each. The projects mainly involve electronic information, optical-mechanical-electrical integration, biotechnology and new medicine, new materials, and comprehensive utilization of protective resources. They span Zhongguancun Science and Technology Park and the districts/counties of Chaoyang, Shunyi, and Daxing. These projects are expected to achieve a production value of 12 billion yuan after implementation.

(2) Cooperative Relationships

As one of a series of science and technology innovation industry-academia-research platforms established by the Beijing Municipal Government, in addition to collecting and publishing scientific and technological achievements from research and development institutions in Beijing, the service platform promotes the actual application of scientific and technological achievements, and is dedicated to solving problems in corporate scientific and technological innovation by collecting corporate-related research needs and bringing together the advantages of research and development institutions in science and technology, thereby providing strong support for high-quality development.

By 2021, 63 municipal state-owned enterprises had published projects with innovation needs. The service platform has also established strategic cooperation relationships with research and development institutions such as Peking University, Tsinghua University, Beijing Jiaotong University, Beijing Institute of Technology, Beijing University of Technology, and the Chinese Academy of Sciences, releasing the scientific and technological innovation achievements of these institutions in the form of investment promotion campaigns. High-tech companies such as Beijing Automobile Works, Baidu, Megvii Technology, and Beijing Railway Rolling Stock Co., Ltdmade final decisions at the campaign site, signing over 40 cooperation agreements with Beijing Institute of Technology, Tsinghua University, etc.

The service platform also engages in high-tech industry matching. Science and technology resource sharing service platforms such as Zhongguancun Science and Technology Park select and publish information from industry experts on the internet, artificial intelligence, high-end manufacturing, new materials, energy saving and environmental protection, It organizes science and technology strength enhancement and science and technology market factor matching activities centered on the two main industrial sectors of high-end smart manufacturing and energy saving / environmental protection, inviting many universities and research and development institutions such as Peking University, Beijing Institute of Technology, and the Institute of Physics of the Chinese Academy of Sciences to

participate in the exchange and guidance of companies in the relevant industries. At the same time, organizations such as China Technology Exchange were invited to the center to conduct publicity and promotion activities, proactively establishing communication routes with companies.

(3) Achievements and Areas of Expertise

The service platform's maturity assessment of scientific and technological achievements is one if its strengths. The maturity of scientific and technological achievements generally reflects the degree of technical practicality of scientific and technological achievements, their positioning in the technology lifecycle, and the completion of the process and support resources needed for the realization of the achievements. The maturity also reflects the state of technological development in specific systems or projects, and the satisfaction with technology in achieving and realizing the expected goals of systems or projects.

In 2015, commissioned by the Beijing Association for Science and Technology, the Capital Science and Technology Service Industry Association, the China National Institute of Standardization, etc., discussed and created a technology achievement transformation maturity evaluation standard⁶³, which was officially published in August 2016. The standard is applied when project outcome owners, demand sides, financial institutions, third-party evaluation institutions, and government management departments evaluate the maturity of technology achievement transformation basis and operational regulations for research and development institutions to carry out technology achievement transformations.

(4) Success Stories

A state-owned central enterprise's research institute has a complete innovation chain consisting of preliminary research, research and development, production, sales, and after-sales service. Additionally, it holds over 600 authorized patents, ranks within the top 3 in the industry for research capability and production conditions, and has an annual production value of more than 5 billion yuan. Since the institute does not have a specialized arm for achievement transformation, it cooperates closely with this service platform, and the platform and research and development institutions in Shanghai provided specialized guidance for the transformation of the institute's technological achievements. Focusing on the actual situation of the transformation of research results of state-owned central enterprises and large research institutes, three important decision points were established and evaluated according to the process of transformation of high-tech results: selection of high-value results, selection of transformation of profits from the transformation of results.

The research institute's technology department was assisted in organizing its bank of scientific and technological achievements, selecting achievements based on their relevance to the main business and their commercial value, and adopting four corresponding methods for handling the achievements.

Category A scientific and technological achievements: Valuable outcomes related to the organization's core

⁶³ The science and technology achievement transformation maturity evaluation standard ("科技成果转化成熟度评价规范") is a group standard of the science and technology service industry, serving as a basis of evaluation and manual when scientific and technological institutions carry out technology achievement transformation. It stipulates terms and definitions related to the maturity of science and technology achievement transformation, evaluation principles, evaluation content, evaluation methods, evaluation processes, and evaluation reports. It is applicable when project outcome sides, demand sides, financial institutions, third-party evaluation institutions, and government management departments evaluate the maturity of technology achievement transformations.

technologies or main products, which can be implemented through self-investment and not transferred externally.

Category B scientific and technological achievements: Although not related to the main business, they currently generate high-value outcomes through transformation, and due to the characteristics of the achievements, methods such as external transfer, licensing, or equity investment can be chosen to continuously increase the income from scientific and technological achievements.

Category C scientific and technological achievements: Valuable in themselves but require continuous investment in subsequent research and development to mature for transformation. There is the option to select corresponding routes to launch research and development projects, obtain internal and external funding and resource support through challenge or innovation funds, transfer them externally, license them, or choose to cooperate in transforming them.

Category D scientific and technological achievements: Those without value for transformation, some merely used by researchers for professional evaluation, should be liquidated promptly to reduce unnecessary maintenance costs related to these achievements.

(5) International Cooperation

In collaboration with the National Eastern Tech-Transfer Center, a cooperation agreement was signed with Germany's Steinbeis, aiming for cooperation in international technology transfer platforms and personnel training bases while broadly utilizing Steinbeis's global innovation network and resources to expand innovation and entrepreneurship project cooperation. Strategic level cooperation has also been conducted with research-oriented foreign-funded enterprises such as ABB Beijing Drive Systems, Intel China Research Centre Ltd, Hitachi China, and MSD China.

(6) Challenges and Development Goals

The transformation of scientific and technological achievements involves multiple players, links between many points, and is a complex system with multiple factors working synergistically. Connecting and completing these requires high-level, multi-talented, professional talent. Therefore, connecting the supply and demand sides of achievements, and leveraging the potential of intermediary multi-talented individuals, is vital for accelerating the transformation of scientific and technological achievements.

The service platform has focused on research incentives for the transformation of scientific and technological achievements, concentrating on researchers at universities and research and development institutions as the supply side, thus neglecting internal incentives for providing specialized services that link demand and supply. In the future, securing talents with both technical strength and business skills, solving the puzzle of how to maintain and secure such high-level personnel, and promoting the development of an organizational culture that supports internal and external knowledge transfer is needed, necessitating the design of a scientifically based incentive mechanism.

4.3.2 Xi'an Jiaotong University National Technology Transfer Center

(1) Organizational Structure and Overview

Xi'an Jiaotong University National Technology Transfer Center was established in June 1999 as a comprehensive intermediary institution engaged in technology transfer, achievement transformation, equity management, and industry-academia-research collaboration on behalf of Xi'an Jiaotong University. To explore a market-oriented operation mechanism for technology transfer, the university established Xi'an Jiaotong University Technology

Achievement Transfer Co., Ltd., with the center and the company operating as a unified entity. It currently has 78 staff.

In 2001, the center became one of the first six National Technology Transfer Centers of universities recognized by the National Economic and Trade Commission and the Ministry of Education. In 2008, it was certified by the Ministry of Science and Technology as the first National Technology Transfer Demonstration Organization and was included in the first round of the university-specialized national technology transfer organization construction pilot project by the Ministry of Science and Technology and the Ministry of Education in 2021.

In 2018, the center reformed its institutional mechanism according to the five missions/tasks assigned by the country: (1) development and popularization of common technologies, (2) promotion and improvement of enterprise technology centers, (3) promotion of university achievement transformation and technology transfer, (4) strengthening of cooperation in international technology innovation, (5) provision of comprehensive services to enterprises.

After three years of development and exploration, the center completed another organizational restructuring in 2022 to respond to rapid business expansion, launching three main business departments: regional management, technology development, and ecological operations. Additionally, it reorganized into three business centers: the Education Training Center, the Strategy Development Center, the Concept Demonstration Center, and three functional departments: the Audit Department, the Finance Department, and the General Affairs Department.

The center now has 38 bases in locations including Shizuishan, Zhongwei, Baotou, Lixi New City, Hanzhong, Xianyang, Weinan, Yan'an, Yuncheng, Sanmenxia, Xinmi, Zigong, Tangshan, Shijiazhuang, Rizhao, Zaozhuang, Shenfu, Hefei, Wuxi, Zhenjiang, Yancheng, Suqian, Huzhou, Jinhua, Xiamen, Fuzhou, Quanzhou, and Qingyuan, with a team of over 40 professional technology intermediaries, directly linking technology transfer services and university achievements with market needs at the frontline, creating a virtuous cycle of sustainable development.

In recent years, the center has not only contributed to the construction of the industry-academia-research system centered on the university but also focused on building a management team centered on professional technology intermediaries, steadily building its own specialized technology transfer organization under the policy of "contributing to the construction of double first-class disciplines of the university, contributing to Shaanxi Province, and expanding nationwide."

(2) Cooperative Relationships

On the needs-side represented by enterprises, in a complex and diverse market and technology environment, demands for innovative product performance, services, and upgrades are increasingly high, making the transformation of technological achievements into productivity an urgent requirement. In this context, in addition to achieving seamless connections between technology transfer organizations' technological services and the market, the construction of national technology transfer regional centers is urgently needed.

Facing these issues, the Xi'an Jiaotong University National Technology Transfer Center proposed the first model for regional technology transfer center construction in China, integrating various key factors of industry-academiaresearch according to regional industry needs through various operational models and operators such as directly managed branches, industrial technology research institutes, pilot bases, and intellectual property rights operation centers, cutting open the transformation chain of university scientific and technological achievements.

The center has now formed a technology manager training team centered on key personnel and fixed teams of professional technology intermediaries at local branches. Moreover, the center cooperates closely with the National

Technology Transfer Northwest Center, Zhongzhong Zhiguang Technology Transfer Co., Ltd, Shanghai Shengzhihua Intellectual Property Service Co., Ltd., accumulating many cooperative talent resources. Furthermore, considering local realities, the center operates across various models such as industrial technology research institutes, incubators, pilot bases, and intellectual property rights operation centers. For example, the Zhengzhou Center focuses on constructing an intellectual property rights operation system based on technology transfer, the Sanmenxia Center on building an industrial technology research institute based on technology transfer, and the Xinmi Sub-Center on operating an incubator based on technology transfer.

(3) Achievements and Areas of Expertise

The Xi'an Jiaotong University National Technology Transfer Center clarifies the responsibilities of each functional department ensuring they complement each other's strengths. It first implements a business model that allows local branches to contribute to regional economic development from multiple angles and explores and innovates to accelerate the transformation of the university's scientific and technological achievements. In 2019, the center completed 70 technology transfer projects, with a total transaction amount of 256.42 million yuan. Of this, the investment total for a new material project based around piezoelectric single crystals was 152 million yuan, the intangible asset valuation of the same project was 125 million yuan, the technology transaction amount for cross-university cooperative themes was 12.23 million yuan, and the technology transaction amount for local companies was 92.19 million yuan, serving a total of 727 companies.

The center operates 18 local branches in locations such as Shizuishan, LIXI New City Jinhua, and Xiamen, facilitating interaction between localities and enterprises, not just supporting regional economic development, but also promoting the development and establishment of university disciplines. A complete evaluation process is in place for the establishment of local branch institutions, adhering to the principle that the establishment of branches must result in a win-win situation for both the supply and demand sides of scientific and technological achievements. Before establishing branches, the center thoroughly investigates the advantages of the local area and industry within the technology transfer market, while considering the strengths of Xi'an Jiaotong University and universities in Shaanxi Province, and only establishes branches in locations that meet the establishment criteria after comprehensive analysis and evaluation.

The quality of technology intermediaries is also a key advantage. After careful consideration, the center summarized the pros and cons and finally presented three requirements for the technology intermediaries of the branches: "specialization," "dedication," and "localization." To achieve efficient operation and national deployment of the branches, characteristics of technology intermediaries such as the three above are fully implemented across all of them, with the headquarters setting unified standards for hiring, training, and positioning of the intermediaries.

(4) Success Stories

The Xi'an Jiaotong University National Technology Transfer Center Yangzhong Branch (Yangzhong is a city in Jiangsu Province) promotes technical exchange and cooperation between Xi'an Jiaotong University and companies in Yangzhong, centering on industries such as electrical engineering, new materials, smart manufacturing, and energy conservation and environmental protection, and has built an industry-academia-research cooperation mechanism for contributing to the economic and social development of Yangzhong.

The branch was established in the Yangzhong High-Tech Park, with dedicated staff (mid-level engineers with
master's degrees) responsible for daily operations and project implementation. In 2019, the Yangzhong Branch visited an average of 5 companies per month, responded to over 100 various types of technology needs, and through a yearlong tracking of the sectors and technological development dynamics of companies, presented 41 achievements and 281 patents to 22 key organizations in Yangzhong City. In addition, along with 10 industry-academia-research activities, three industry-academia-research activities were conducted, involving at least 5 specialized professors and more than 5 companies.

In May 2019, Xi'an Jiaotong University and the Yangzhong Municipal People's Government signed a framework agreement on cooperation in the industrialization project of the piezoelectric single crystal new material technology, confirming their joint promotion of the industrial transformation of this project in Yangzhong City. Meanwhile, Yangzhong Jinhang Stock Investment Partnership, Xi'an Lanjing New Materials Partnership, Xi'an Jiaotong University Asset Management, and Jiangsu Weiteng Electric Co., Ltd signed a cooperation agreement on this project. The total investment of the project was 152 million yuan, of which the stock evaluation of intangible assets was set at 125 million yuan.

The Sanmenxia Center is one example of success. Since its establishment, it has built a good cooperative relationship with the city's administrative system through business development and operations, receiving high praise from departments at all levels. After the initial accumulation of information and considering the actual situation, the center supported the preparation for the establishment of the Sanmenxia City Industrial Technology Research Institute, adopting a series of activities based on industry-academia-research cooperation centered on the needs of the industry. Specifically, it promoted activities to bring the scientific and technological achievements of universities in Shaanxi Province to Sanmenxia, establishing for the first time a new type of industry-academia-research cooperation platform led by companies, and attempted to innovate the model of local government attracting science and technology companies based on industry-academia-research cooperation.

The Xi'an Jiaotong University National Technology Transfer Center introduces new technologies, industries, and opportunities to the local community, advancing local industrial placement based on technology, and strives to promote the integration of science and technology innovation resources with industrial development. Such activities have been recognized and closely watched by leaders of the Henan Provincial Party Committee.

(5) International Cooperation

The International Technology Transfer Office within the Xi'an Jiaotong University National Technology Transfer Center is responsible for international cooperation. Its main responsibilities are to explore the introduction of overseas technology transfer operation models and successful experiences. Specifically, it aims to promote the dissemination of international achievements and technology transfer, and capital operations, as well as facilitate the introduction of scientific and technological achievements domestically, local incubation, transfer, and transformation. It also aims to jointly establish companies and technology research centers between enterprises and research and development institutions internationally, providing policy consulting and bridging services for corporate cooperation. Its other activities include exhibiting technological innovations, the organization of national and international events, and the international provision of comprehensive services in technology, human resources, information, law, management, and training.

In December 2019, the center, together with the China-Arab Countries Technology Transfer Center and the China-ASEAN Technology Transfer Center, jointly signed the initiative for the Belt and Road Technology Transfer Services Alliance. The alliance is dedicated to (1) establishing an efficient cooperation and coordination mechanism, and (2) promoting the free flow of innovation factors such as projects, personnel, and capital with countries and regions along the Belt and Road.

Furthermore, the Xi'an Jiaotong University National Technology Transfer Center has established strategic cooperation relationships in the field of industrialization of scientific and technological achievements with over 13 universities, research and development institutions, and science innovation companies from six countries, including the USA, Germany, the UK, France, Japan, and Italy, from the levels of government, industry, academia, and research.

The center is one of the first batch of 18 organizations of the China-ASEAN Technology Transfer Alliance established in 2022, having already signed memoranda of cooperation with ministries of science and technology in Vietnam and Indonesia, planning to cooperate at the project level in technology transfer and scientific and technological cooperation in the future.

(6) Challenges and Development Goals

Currently, the center, based on local branches, explores and practices various business modes based on technology transfer, such as science and technology market services, trial operation of achievements, research and development of industrial technology, and operation of intellectual property rights, responding to the needs of social industries and providing pioneering knowledge for the construction and strengthening of national technology transfer regional centers. The Chinese government has continuously introduced policies to support scientific and technological innovation, and the center is committed to continuing exploration and practice to enhance the transformation of scientific and technological achievements.

4.4 Technology Property Right Exchange Organizations

4.4.1 China Technology Exchange Information Service Platform Co., Ltd.

(1) Organizational Structure and Overview

China Technology Exchange Information Service Platform Co., Ltd. (CTEISP) was established in August 2009 with a registered capital of 224 million yuan. It is an organization jointly established by the Ministry of Science and Technology, the National Intellectual Property Administration, the Chinese Academy of Sciences, and the Beijing Municipal People's Government. It is mainly engaged in intellectual property rights operation and trading, providing

value assessment, transaction matching, public bidding, project incubation, science and technology finance, policy research, and other services related to intellectual property and scientific and technological achievements trading.

To promote the construction of Beijing as an international science and technology innovation center, the Beijing Municipal Committee and the municipal government established the Beijing Intellectual Property Exchange ("北京 知识产权交易中心") based on CTEISP. The Beijing Intellectual Property Trading Center integrates and optimizes CTEISP's current functions such as technology trading prices and the transformation of scientific and technological achievements, building and improving a registration, pricing, specialization, and financial integration service system for intellectual property rights, becoming a crucial infrastructure for the national science and technology innovation center and an important hub for the international intellectual property trading market.

As a national-level technology and intellectual property trading institution authorized by the State Council, CTEISP has adhered to a service philosophy of "fairness, openness, innovation, and efficiency" since its inception, strengthening cooperation with institutions in the same field, and building a cooperative and open third-party trading platform. It effectively integrates technology project resources, investor resources, and intermediary service resources, providing low-cost and high-efficiency professional services to participants involved in intellectual property transactions, responding to various needs in the industrialization process of scientific and technological achievements, promoting the early transformation of technology into productivity and societal wealth, and driving national and industrial innovation.

CTEISP adheres to an innovative service concept of technology capital services, newly establishing a technology transaction network platform, an innovation platform for science and technology financing, and a market-oriented operation platform for science and technology policy. It also forms a series of technology and intellectual property service platforms, cooperating with professional intermediary organizations such as mediation, consulting, and evaluation, providing various forms of professional services related to intellectual property rights such as patent technology and trademarks.

Specifically, it includes services for listing and trading of scientific and technological achievements, public notification services for state-owned scientific and technological achievements, bidding and trading services for scientific and technological achievements, matching services for scientific research resources, evaluation and assessment services for scientific and technological achievements, transaction settlement services, technology contract registration services, construction services for technology transaction service systems, network platforms, consulting on science and technology policies, research on science and technology policies, research on strategic emerging industries, special training in the field of innovation and entrepreneurship, intellectual property consultation services, design and implementation of transformation plans for science and technology projects, financing services for science and technology projects, incubation operation services, and construction and project management of science and technology projects management information platforms, including forums and exhibitions.

(2) Cooperative Relationships

The transformation of scientific and technological achievements is inseparable from capital support. CTEISP leverages the advantages of resources gathered in projects, deeply explores the interests and preferences of industrial investors, and combines the demands of financial investors and other capitals to promote effective integration between capital and technology. Simultaneously, it actively develops science and technology financial products, embodying the concept of financial services throughout the entire process of technology transfer and transformation.

For example, in a brain electrical impedance tomography (EIT) project, CTEISP introduced the investor Beijing Yibuke Technology Co., Ltd and decided to incubate the EIT technology developed by the Fourth Military Medical University (which had already completed the development of a prototype). Furthermore, during the operation period of the project, CTEISP solved other difficulties faced in the process of technology transfer and provided a series of services for the gradual financing by 易布客 towards the industrialization of EIT technology, including intangible asset evaluation, investment plan design, and third-party settlement

CTEISP actively cooperates with specialized investment institutions and social capital to attract investments in startups and promote the establishment of various forms of investment funds, advancing investment in startups and the introduction of overseas technology to Beijing. For instance, CTEISP, in collaboration with Israel's Infinity and Beijing Zhongguancun Startup Development Center, established the Zhongguancun International Technology Transfer Investment Fund, focusing on introducing international cutting-edge technologies from Israel and the United States to Zhongguancun through technology transfer, talent introduction, and industrial promotion. Moreover, CTEISP initiated the establishment of the Richland CTEX Startup Investment Fund and Zhongji Global Technology Creative Investment Fund with several specialized investment institutions. The total scale of these funds reached about 500 million yuan.

Universities play a crucial role in scientific and technological innovation activities. CTEISP actively collaborates with the Chinese Academy of Sciences, Peking University, Tsinghua University, and Xiamen University, fully leveraging the academic and regional advantages of these universities and research and development institutions. It also actively incorporates national strategic needs, introduces and integrates abundant external resources, constructing a scientific and technological achievement transformation platform covering the entire industrial chain of scientific and technological achievement transformation.

As a platform for cooperation with universities, CTEISP established the China Technology Exchange Maritime Silk Road⁶⁴, serving as a platform while leveraging the strengths of universities to enhance the training of technical agents and specialized personnel in scientific and technological services. It adopts a bidirectional approach to both introducing foreign technologies and facilitating overseas expansion, building substantive cooperative relationships with technology transfer organizations of universities within the consortium and international companies transferring advanced technologies, utilizing their excellent innovation and service resources.

(3) Achievements and Areas of Expertise

Intellectual property is the core of CTEISP, with the development of its technology trading business mainly depending on the development of IP business, and the development of its science and technology finance business also centered on IP business. Other services like technology contract registration are auxiliary to the development of its IP business, and constructing a flawless and systematic IP business platform is a key challenge CTEISP must address.

As an IP intermediary service platform, CTEISP connects technology supply and demand through various subplatform systems and support systems, such as platforms for trading patent technology nationwide via the internet,

⁶⁴ University Consortium of the 21st Century Maritime Silk Road: A non-governmental, non-profit, and non-corporate international higher education consortium formed by high-level universities worldwide on an equal and autonomous basis.

earning revenue through a certain percentage of agency fees and service charges. It provides a series of support service systems, such as a patent value online analysis system, patent online application system, IP customized industry database, and management systems, to realize the creation, operation, evaluation, management, and protection of intellectual property rights for customers of different maturity levels.

Leveraging the advantages of resources from institutions like the Beijing Stock Exchange, the Ministry of Industry and Information Technology, the National Intellectual Property Administration, the Ministry of Science and Technology, the Beijing Municipal Government, famous domestic and foreign law firms, accounting firms, IP service organizations, Beijing New Media Communication Technology Co., Ltd, the State Intellectual Property Publishing House, CN-KnowHow IP Group, and Deheng Law Offices, CTEISP has built an effective support system for its business expansion.

On November 11, 2022, securities guaranteeing the ownership of intellectual property rights generated by the CTEISP-Zhongguancun Guarantee-Yangtze-2nd Phase Intellectual Property Rights Support Special Plan were successfully issued on the Shenzhen Stock Exchange, with an issuance scale of 202 million yuan, an issue interest rate of 3%, a maturity of 1 year, and a debt rating of AAA. The special plan was sold out upon listing, with over 10 investment institution candidates participating, exceeding the subscription by 204%, and filling the quota of 202 million yuan, with Bank of Beijing, China Minsheng Bank, Pudong Development Bank, Bank of China, China Merchants Bank, and Bank of Shanghai becoming the final investors. In the second phase of the special plan, intellectual property financing solutions were provided to 15 high-tech companies in Zhongguancun Science City. The pooled companies included six "specialized, refined, distinctive, and innovative enterprises," with the pooled patents consisting of 35 invention patents and 9 utility model patents in fields such as next-generation information technology and digital creation, valuing the patent assets at 230 million yuan.

Moving forward, CTEISP will actively collaborate with the Shanghai Stock Exchange, Shenzhen Stock Exchange, and Beijing Stock Exchange to promote the proliferation and innovation of financing products like intellectual property securitization, strengthening the integration of innovation, industry, capital, and talent chains, and aiming to provide high-quality, specialized services for the innovation development of science and technology-type companies. In daily operations, CTEISP handles the transfer of property rights of science and technology-type state-owned enterprises on the Beijing Stock Exchange, providing services throughout the entire transfer process.

(4) Success Stories

(1) Superhard Material Patent Navigation Analysis Project

The Superhard Material Patent Navigation Analysis Project, implemented by the Patent Administration Department of the National Intellectual Property Administration and Zhengzhou Municipal Government, with CTEISP primarily responsible, involved the participation of the Henan Provincial Intellectual Property Office, relevant departments of the Zhengzhou Municipal Government, and related companies and organizations in the Zhengzhou New Material Industrial Cluster and Experimental Zone. Based on the overall implementation plan of the National Intellectual Property Administration, CTEISP subdivided the implementation steps and clarified the division of labor to establish a smooth working mechanism and ensure the implementation and promotion of the Zhengzhou superhard material patent navigation analysis.

CTEISP comprehensively organized the key points of the superhard material industry chain, broke up the technological branches of each key point, and created a map of the industry chain's structure combining horizontal

and vertical axes according to the realities in the industry. Based on this map, CTEISP conducted patent searches for each technological field, assessed the patent distribution, analyzed technological development trends and routes, and analyzed the key points of the industry chain, core technology holders, and their deployment areas. It clarified the industrial positioning of industrial parks within the industry chain and analyzed the positioning and development routes of leading companies within the industry chain, drawing a patent map for the superhard material industry within the experimental zone.

By participating in the superhard material industry's patent navigation, CTEISP deeply understood and mastered the application of patent navigation in the layout of industrial development, exploring the integrated development of industry patent maps and patent trading business. This has laid a good foundation for CTEISP to develop high-end services in patent transactions in the future.

The navigation analysis is expected to be linked with major customer patent transactions, promoting a leap in the development of CTEISP's traditional business. CTEISP plans to expand other projects such as new energy patent navigation and new material patent navigation based on this project.

(2) Foxconn Technology Group's Patent Trading Business

Under the commission of Max Smart Capital Far East Co., Ltd, CTEISP acted as the exclusive technology transfer transaction entity contracted by the company for the first time in China. It undertook public disclosure, organized display, and auctioning of patents under its jurisdiction. Max Smart is a specialized intangible asset management institution under Foxconn Technology Group, responsible for managing intangible asset transactions across the Foxconn Group. Foxconn's rapid increase in patent applications and grants over the years has been remarkable, positioning it as a pioneer in intellectual property rights in global science and technology as a Chinese enterprise.

After years of rapid development, Foxconn has built a professional R&D network across Asia, America, and Europe, establishing its own innovation platform based on an elite R&D team, accumulating a large number of core and key technologies with broad competitiveness. Technologies such as nanotechnology, thermal conductivity technology, nanoscale measurement technology, wireless network technology, green environmental protection technology, CAD/CAE technology, optical coating technology, ultra-precision composite/nanoscale processing technology, SMT technology, network chip design technology, cloud technology, and e-supply chain technology have achieved significant technological breakthroughs in nano, metal, plastic, ceramics, and thermal conductivity fields. Foxconn leads in precision machinery & molds, semiconductors, cloud computing, LCD displays, computers, wireless communications, and networks, and is a world-leading technology company in the integrated field of machinery, optics, and electronics.

By soliciting needs through various channels and matching transactions, CTEISP successfully facilitated over 6.2 million yuan in patent transactions for the Foxconn Group by 2021, marking a new development stage for its patent trading business Additionally, many renowned institutions such as China International Marine Containers, Skyworth Group, and the China Academy of Launch Vehicle Technology have participated in the patent transaction platform.

(5) International Cooperation

To strengthen international scientific and technological exchanges and cooperation, and to promote cross-border technology and industry transfers, CTEISP has established extensive business cooperation routes with more than 400 international technology transfer organizations, including the World Intellectual Property Organization (WIPO), the Sino-Scandinavian Innovation & Entrepreneurship Centre (SSEIC), the China-Finland ICT Alliance, and Israel's

Trendlines Incubator Group. Furthermore, CTEISP has constructed a shared database containing information on more than 2 million companies worldwide, stocking a large number of high-quality international technology transfer project resources, and conducting matching and exchange activities with national science and technology parks.

The development of international scientific and technological cooperation is a necessary path for the domestic economy and the development of science and technology. CTEISP is committed to international innovation cooperation in the following areas: First, it will enhance data interoperability and supply market needs with scientific and technological resources, promoting the construction of science and technology innovation platforms and the advanced aggregation of resources. Next, it will establish a cooperation mechanism for the transformation of Russian scientific and technological achievements, opening gateways and channels for domestic and international innovation cooperation, gathering various service organizations for cross-border scientific and technological cooperation and transformation of achievements, and regularly conducting project dissemination activities. Finally, it will optimize the evaluation and assessment system for multinational projects, improving standards and service systems for cross-border technology transaction processes, and continuing to promote innovation and development in the international technology transaction market.

(6) Challenges and Development Goals

In the development of its intellectual property business, the profitability of some of CTEISP's service products is limited, and its price negotiation power is weak. For example, CTEISP does not qualify as an agent for patent application services, and its remuneration for domestic patent application assistance services is relatively low, making these limitations an issue it needs to resolve in the future.

In some businesses with relatively standardized processes, CTEISP's price negotiation power is weaker than that of other customized business negotiations. For instance, its current volume of intellectual property litigation services is overall low. It has a higher proportion of domestic services, but these are characterized by a relatively low price range of about 5,000 yuan per case. Although its level of overseas businesses is lower, the average price per case can reach 40,000 to 50,000 yuan. Therefore, CTEISP faces certain obstacles in achieving a balanced development of its domestic and foreign businesses.

Due to a late start, CTEISP, despite receiving support from national resources, has weaknesses in developing corporate needs, building a service quality evaluation system, cross-border settlement business, etc., indirectly leading to a weak brand influence on the international stage. Hence, overcoming the obstacles in its business, brand, and service systems is an urgent issue that CTEISP needs to address in its science and technology services.

4.4.2 Shenzhen United Property and Share Rights Exchange Co., Ltd.

Organizational Structure and Overview

Shenzhen United Property and Share Rights Exchange Co., Ltd. (United Exchange) was established based on the Shenzhen Property Rights Exchange Center founded in March 1993 and the Shenzhen International High-Tech Property Rights Exchange founded in October 2000. The Shenzhen Property Rights Exchange Center was one of the earliest property rights trading institutions established in China. The Shenzhen International High-Tech Property Rights Exchange was the first market-oriented, limited company intellectual property and scientific and technological achievement property rights trading institution in China, approved by the Shenzhen Municipal Government under

the directive of Li Changchun, a member of the Politburo of the Chinese Communist Party and Secretary of the Guangdong Province.

In November 2009, at the 148th Executive Meeting of the 4th Session of the Shenzhen Municipal Government, the "Implementation Plan for the Integration of Property Rights Trading Institutions to Accelerate the Development of the Property Rights Trading Market" was adopted, deciding to integrate Shenzhen's property rights trading market and establish the United Exchange, positioning it as a unified and comprehensive property rights trading platform in Shenzhen.

Since the integration, with strong support and guidance from various municipal government departments and the Municipal State-owned Assets Supervision and Administration Commission, after years of development, the United Exchange has become a trading platform for state-owned and group enterprises' property rights transfer, asset disposal, and capital increase.

In August 2019, in accordance with the requirements for the integration and reform of state-owned asset resources in Shenzhen, the United Exchange was incorporated into the Shenzhen Trading Group Transaction Group (Shenzhen Public Resources Trading Center), becoming one of the important member companies of the Shenzhen Trading Group. In 2021, the State-owned Assets Supervision and Administration Commission Office of the State Council issued the "Notification Regarding Shenzhen United Property and Share Rights Exchange Conducting Business Related to the Interests of Central Enterprises," designating the United Exchange as a transaction institution for central enterprise rights and interests (property rights transfer and enterprise capital increase). The United Exchange has become one of the six domestic property rights trading institutions with a "full license" to trade state-owned assets of central enterprises.

Since its establishment, the United Exchange has provided various types of property rights trading services for all levels of state-owned enterprises, including physical asset disposal, share transfer, and capital increase, with its transaction scale, market influence, and resource allocation ability among the top in China's property rights trading institutions, accumulating a total transaction volume of over 1.7 trillion yuan.

(2) Cooperative Relationships

The technology and intellectual property rights trading platform of the United Exchange integrates the related businesses of the original Shenzhen International High-Tech Property Rights Exchange's technology and intellectual property rights trading platform. The multi-level capital market system including the United Exchange further deepens cooperation with universities, research and development institutions, technology companies, private equity, and venture capital, jointly promoting the integration of high-level technology, high-level talents, and innovation resources.

Since its establishment, the United Exchange's technology and intellectual property rights trading platform has signed strategic cooperation agreements online or offline with 56 institutions, including government departments, high-tech parks, universities, research and development institutions, technology transfer organizations, securities trading centers, commercial banks, investment institutions, such as the Shenzhen Center for Science and Technology Evaluation and the China Association of Science and Technology Evaluation and Management of Scientific and Technical Achievement, and the Shenzhen United Exchange Science and Technology Achievement and Intellectual Property Trading Center. The contracted cooperative service institutions provide many professional services for the United Exchange's technology and intellectual property rights trading platform, including intellectual property

operation, representation, financing, evaluation, arbitration, legal services, etc.

Since March 2022, the United Exchange's technology and intellectual property rights trading platform and the Shenzhen Virtual University Park have been holding exchanges and cooperating in personnel training in the field of scientific and technological services. Founded in 1999, the Shenzhen Virtual University Park is China's first innovative demonstration base for industry-university-research cooperation, integrating resources from universities at home and abroad. The model base was jointly constructed by numerous universities and cities in one park, recognized as a national high-tech enterprise service center by relevant national departments, committees, provinces, and cities, and as a Guangdong Province Ministry of Education industry-university-research integration demonstration base, with 68 famous universities from home and abroad participating. These include 51 domestic universities such as Tsinghua University and Peking University, 6 universities from Hong Kong such as the University of Hong Kong and the Chinese University of Hong Kong, and 8 overseas universities such as the Georgia Institute of Technology.

(3) Achievements and Areas of Expertise

The United Exchange's technology and intellectual property rights trading platform is positioned to provide onestop services for the transaction, transfer, and transformation of scientific and technological achievements, exploring and improving the market-based pricing and trading mechanisms for intellectual property rights and scientific and technological achievement property rights, and establishing a national comprehensive service platform that connects the technology market with the capital market.

In 2012, the United Exchange took the lead in the industry to construct a property rights platform + investment banking services business model for state-owned enterprise capital increase, maximizing the platform's advantages in information collection, value discovery, and regulatory standards. It also works to attract strategic investors, as well as design schemes, disseminate information, gather investors, perform selection, etc., thereby providing a series of professional and market-oriented services to strengthen state-owned enterprises.

The main businesses of the United Exchange's technology and intellectual property rights trading platform cover technology transaction services and related information services for docking technology and capital, etc. Currently, the specific services related to capital offered by the exchange, when integrated with technology and intellectual property rights, include firstly, information services for intellectual property rights financing. This includes matching with lenders such as banks, introducing specialized service institutions for evaluation, collateral, and insurance, as well as information services related to intellectual property rights financing include collecting needs, disclosing information, and activities such as regular investment promotion campaigns in cooperation with government and market institutions.

In 2021, the United Exchange reached a total transaction volume of 427.3 billion yuan, marking a 15.7% increase from the previous year. The transaction scale hit an all-time high, with the technology and intellectual property rights transactions amounting to 34.4 billion yuan, a 12% increase from the previous year, further optimizing the business environment for technology and intellectual property rights transactions. By the end of 2021, the United Exchange had served 300,000 companies, with 600,000 individual transactions and a total transaction volume of 2.12 trillion yuan. In addition, it had nurtured 98 listed companies, facilitated mergers, acquisitions, and reorganizations for 8 listed

companies, supported 65 companies in listing on the New Third Board⁶⁵, and achieved an increase in the value of state-owned assets exceeding 50 billion yuan.

(4) Success Stories

To further deepen the construction of the United Exchange's science and technology and intellectual property rights operation service system, promote innovation achievements, benefit more innovation enterprises, and enhance the transformation rate and implementation efficiency of scientific and technological achievements of innovation carriers, the United Exchange launched a patent technology action plan to support the development of small and medium-sized enterprises in 2020.

Huawei Technologies Co., Ltd. was the first major technology company to participate in this. The specific implementation plan by Huawei amongst this series of plans is as follows: Namely, the Huawei Patent Technology Transaction Plate, jointly established by the United Exchange and Huawei, uses Huawei's patent technology to support the technological transformation and upgrade of several science and technology-type small and medium-sized enterprise groups, with a plan to cultivate 100 national high-tech enterprises within three years by 2024. The enterprises selected for this action plan will pay a technology transfer fee of 20,000 yuan. The remaining 180,000 yuan of patent fees will be paid after the enterprise completes the transformation and application and successfully applies to become a national high-tech enterprise. If the application is unsuccessful, there is no need to pay the remaining amount.

(5) International Cooperation

On October 9, 2012, the United Exchange and Ocean Tomo of the United States signed an agreement in Chicago for the establishment of a Chinese-American technology transfer center and the joint research and development of a Chinese-American intellectual property rights index, officially announcing the establishment of the Chinese-American Technology Transfer Center.

The center aims to build a global trading network for technology and capital, fully absorb advanced ideas and successful experiences from overseas, and actively attract renowned professional institutions to Shenzhen to develop innovation services. It also aims to construct an international technology transfer platform based on the concept of science and technology + finance + services, build an advanced high-end service center for the collection, flow, and allocation of factors, and realize an innovative technology transfer innovation model that combines technology and capital.

The center adopts a platform approach, with its main business content including technology transactions, matching services for technology and capital, consulting and advisory services for intellectual property rights, and investment services for enterprises rich in intellectual property rights. The center is currently promoting four technology property transfers from Stanford University projects, including 3D cell multiplication, drug addiction treatment, activated C molecules, and minicircle DNA, through video presentations.

The primary significance of the Chinese-American Technology Transfer Center is, firstly, in providing a platform

⁶⁵ New Third Board: A Chinese over-the-counter stock market targeting venture companies. It is a market for institutional investors and professional individual investors. It has a less-strict listing criteria but requires a clear business model, similar to regional emerging markets in Japan such as Centrex. It is also referred to as China's NASDAQ.

for bridging domestic and international high-tech property rights transactions. Shenzhen is known for its concentration of high-tech companies, which have the need to transfer high-tech technologies during their development process. The Chinese-American Technology Transfer Center can meet the needs of companies for high-tech transfers. The development of an intelligent index⁶⁶ is the first step in the innovation of scientific and technological and intellectual property financial products in the United States and China.

(6) Challenges and Development Goals

(1) Transactions are of a singular type

Due to the United Exchange's predecessor, the Shenzhen International High-Tech Property Rights Exchange, being initially established to provide a unified venue for state-owned asset transfer transactions, it performs fewer transactions in technology and intellectual property rights. This is also because the income from state-owned asset transfer transactions, which were the United Exchange's main trading products, became its largest source of income. However, as state-owned enterprise reform has deepened, most state-owned enterprises in the Shenzhen area have now completed their reforms. Therefore, state-owned enterprise property rights transfers, which were the core business of the United Exchange, are gradually shrinking. In recent years, through strengthening innovation, the United Exchange has been opening up the market to provide stock transfer, custody, and investment and financing services for unlisted small and medium-sized enterprises.

(2) Lack of specialization in transaction services

Services are vital for intermediary businesses. Such intermediary services in the property rights transaction process can be divided into three stages: pre-stage, mid-stage, and post-stage. The inadequacy of services for property rights transactions is reflected in the current situation at the exchange, where services provided to both parties involved in property rights transactions are only apparent during the mid-stage of the transaction process, that is, during the process of the property rights transaction itself.

There is insufficient investment in services such as research and promotion prior to property rights transactions and the exchange is somewhat lacking in follow-up and digging deeper into customer needs after property rights transactions. This appears to be related to the traditional operations of property rights transaction organizations being entirely composed of mandatory state-owned property rights transactions⁶⁷, a low degree of marketization, and a low emphasis on the importance of services. However, in the future, as non-compulsory business in property rights of non-state-owned enterprises increases, the role of services will be extremely important.

⁶⁶ Mapping new trends and patterns observed and analyzed from numerous data points.

⁶⁷ With the deepening of mixed-ownership reform and the innovation of state-owned enterprises' investment and financing mechanisms, activities of stock investment funds backed by state assets, venture capital funds, and industrial investment funds have become energized, and state capital investment and operation companies have become general trading partners in the field of investment and financing. To prevent the loss of state assets, existing domestic laws, rules, and documents surrounding norms impose strict procedural restrictions on the form of entry transaction procedures such as bidding for the transfer of state-owned property rights to enterprises, but under certain conditions, they allow the transfer of state-owned property rights to enterprises through negotiated transfer, etc.

4.5 Science and Technology Financial Service Organizations

4.5.1 China Technology Finance Association ("中国科技金融促进会")

(1) Organizational Structure and Overview

The China Technology Finance Association was established in 1992 with the approval of the Ministry of Civil Affairs, initiated by Song Jian, former State Councilor, supported by the People's Bank of China, and led by the State Science and Technology Commission and the China Association for Science and Technology. It is an organization under the administration of the Ministry of Science and Technology. As the only national-level organization in the field of science and technology finance in China, since its establishment, the association has actively promoted the construction of a financial environment conducive to the transformation of China's scientific and technological achievements and has been promoting the deep integration of science and technology with finance in China.

The association promotes the construction of science and technology finance infrastructure, opens up the science and technology finance service chain, improves the overall service efficiency of science and technology finance, and constructs and improves the science and technology finance system to fit industrial development and the digital economy. Its services encompass a wide range, including the expansion of venture capital activities for entrepreneurs, promotion of innovation in banking financial products such as intellectual property rights-backed financing, advancement of capital market reforms, science and technology entrepreneurship services, innovation and entrepreneurship education, and training in financial technology and risk management.

Its registered capital is 500,000 yuan, and it employs 76 staff members. It includes internal committees related to venture capital, industrial innovation, science innovation funds, innovation and entrepreneurship education, power and water resources, double innovation in science and technology finance, rural revitalization, industrial promotion, and finance and economy, etc., all engaged in related services.

(2) Cooperative Relationships

As a member-based industry organization, the association provides various services related to science and technology finance to its members. Examples include support to improve business outcomes through programs such as education, technical support, and technical training, establishment of industry standards and norms, and participation in industry licensing and qualification reviews.

Its member enterprise database serves as a channel for information regarding the comprehensive situation of companies participating in the committees. The committees have ensured companies have aggregated within domestic science and technology parks. They have also set up web portals (workstation sites) to produce innovation. In terms of financing, the association can provide comprehensive and integrated professional services at multiple levels and forms of capital markets, including bank loans, corporate bonds, stock transactions, M&A, agency stock holdings, and company listings. The interaction between its workstations and committees enables the implementation and organization of training seminars, meetings and forums, investment promotion campaigns, promotion of achievements, talent recruitment, market development, and overseas exhibitions tailored to the development needs of companies.

Its enterprise project bank aggregates thousands of companies, including technically advanced science and technology-type companies and companies with new products. The materials on these companies include detailed

information such as management teams, technical features, market analysis, and financial status. In addition, many projects have undergone financial audits, with comments from experts being provided.

The association's policy information database has, in recent years, collected and collated preferential policy documents on industrial policies, financial assistance, tax exemptions, etc., issued by the State Council, various ministries, departments and commissions, and local governments for industries and enterprises, making this information available to member companies.

The association also serves as a bridge for external communication. For example, it conducts industry research and uses its detailed data and abundant information to assist the government in formulating effective and enforceable policies, laws, and measures.

(3) Achievements and Areas of Expertise

The association's venture capital committee is China's only national-scale venture capital industry committee. It was established in 2000 with joint leadership from the Ministry of Science and Technology Torch Center and the approval of the Ministry of Civil Affairs. The committee aims to unite institutions engaging in national venture capital activities, promote venture capital exchange activities, facilitate mutual exchange among members and exchange between various sectors, promote standardization and sound development of venture capital businesses, and contribute to the development of the high-tech industry.

Its business scope includes organizing domestic and international exchange activities, serving as a domestic and international exchange hub for venture capital, conducting industry research to study various issues in the development of venture capital, and providing references and support for government decision-making. It also cultivates talents and business skills necessary for the development of venture capital and provides information and consulting to members and government departments and organizations related to venture capital.

(4) Success Stories

(1) Dalian High-Tech Zone Science and Technology Finance Innovation and Service Center

The Secretariat of the Science and Technology Finance Support Double Innovation Special Committee of the China Technology Finance Association coordinated with the Dalian Branch of the Industrial and Commercial Bank of China and the Dalian High-Tech Zone's Management Committee to jointly establish the Dalian High-Tech Park Science and Technology Finance Innovation and Service Center in 2022. So far, it has met the financing needs of 98 high-tech small and medium-sized enterprises, with a financing scale reaching 175 million yuan.

At the same time, the center provides one-stop services for science and technology-type companies, including registration and recording, application guidance, certificate acquisition, and bank account opening.

The center was established as a banking and government cooperation model jointly developed by the high-tech zone, bank, and association.

(2) Science and Technology Finance Innovation and Service Ten, Hundred, Thousand, Ten Thousand Special Action ("十百千万")

The Ten, Hundred, Thousand, Ten Thousand special action for science and technology finance innovation and service is a project conducted by the Ministry of Science and Technology Torch Center, jointly implemented by the Science and Technology Finance Support Double Innovation Special Committee of the China Technology Finance Association and the Industrial and Commercial Bank since 2022. The special action focuses on the innovation of financial products and the improvement of service models, selecting about 10 national high-tech parks to build science and technology finance innovation and service centers, and guiding over 100 cooperation models between the national high-tech parks and the Industrial and Commercial Bank as a government and bank cooperation model. It aims to select more than 1,000 high-tech enterprises as key support targets each year and to increase the loan balance provided by the Industrial and Commercial Bank to high-tech enterprises to over 1 trillion yuan by 2025.

According to reports on progress, 58 national high-tech parks, including Zhongguancun Science and Technology Park, have become the first batch of organizations for which this special action has been implemented. Next, branches of the Industrial and Commercial Bank of China, along with national high-tech parks starting with the Guangzhou High-Tech Park, have jointly established the first batch of 10 science and technology finance innovation service centers. Furthermore, branches of the Industrial and Commercial Bank of China, in collaboration with national hightech parks, starting with the Xi'an Hi-Tech Industries Development Zone, are set to proceed with the establishment of science and technology finance innovation service centers.

(5) International Cooperation

China Technology Finance Association commenced its international cooperation initiatives relatively late. Centered around the International Cooperation Department of the Ministry of Science and Technology Torch Center, it has developed international cooperation business with the China Association for International Science and Technology Cooperation, the China International Association for Promotion of Science and Technology⁶⁸, etc. Regular communication and coordination are conducted with these partners regarding resources such as experts and projects.

Via the China International Association for Promotion of Science and Technology, the China Technology Finance Association has obtained a large amount of information on cooperation regarding related technology projects in the fields of healthcare, low carbon and environmental protection, and elderly care, mainly in Japan. The association has made projects such as the Kobe Biomedical Innovation Cluster⁶⁹ and projects related to carbon neutrality in the environmental conservation field of Ituba Kyoso Co., Ltd., and projects on elderly care experience and technology available to member companies. Communication and business consideration regarding the projects were conducted with China Ping An Group, the Industrial and Commercial Bank of China, some local high-tech park management committees, and science and technology-type enterprises. As a next step, the China Technology Finance Association plans to coordinate related needs and negotiate the content of cooperation with the above partners.

(6) Challenges and Development Goals

With the expansion of organizational reforms, and as the allocation of fiscal funds from the government gradually

- ⁶⁸ The China International Association for Promotion of Science and Technology was established in 1988 with the approval of the State Council Science and Technology Steering Group. It is registered with the Ministry of Civil Affairs and administered by the Ministry of Science and Technology. It aims to gather scientists, educators, financiers, entrepreneurs, industrialists, management experts, and technologis both domestically and internationally to promote the development of science and technology in China, promote the integration of science and technology with the economy, and strengthen international scientific and technological exchange and economic cooperation to realize the industrialization of science and technology.
- ⁶⁹ Started in 1998 to gather research and development institutions such as the RIKEN and universities, high-specialty hospital groups including the Kobe City Medical Center General Hospital, and medical-related companies and organizations on Port Island in Kobe. It provides an environment and services supporting everything from research and development to commercialization through industry-universitygovernment-medical collaboration, creating numerous innovations in the medical field.

decreases, in the future the association's income will mainly come from membership fees, training fees, income from conference activities, and government procurement services. Therefore, playing the role of a servant in the science and technology finance industry, building a service-oriented association, attracting more corporate members, ensuring the vitality of the association, and organizing more activities beneficial to the industry development become its greatest challenge.

Promoting a service-oriented association requires the introduction of market-oriented operations and will also face competition with other organizations and private forces. As the difference in service content among various organizations gradually diminishes, the difference between organizations will be influenced by operational management methods and efficiency quality.

Future development goals and contents include: (1) exploring, guiding, and promoting the formation of financial institutions that can contribute to the commercialization, industrialization, and internationalization of scientific and technological achievements through minor investments in financial institutions (especially science and technology financial institutions), (2) forming various science and technology development funds to support the development of science and technology industries and technological advancement, (3) conducting intermediary businesses such as technology consulting, technology training, technology services, technology transfer, technology contracts, technology development, and the integration of science and technology finance and the transformation of achievements, etc.

4.5.2 Inner Mongolia Science and Technology Financing Comprehensive Service Platform (内蒙古科技融资综合服务平台)

(1) Organizational Structure and Overview

The Inner Mongolia Science and Technology Financing Comprehensive Service Platform (operated by Inner Mongolia Productivity Promotion Center) was established in 2004, with a registered capital of 9.05 million yuan and a staff of 37, 95% of whom hold bachelor's degrees or above. This platform is a 100% state-owned enterprise belonging to the Inner Mongolia Department of Science and Technology and is one of the first enterprises in the autonomous region to engage in venture capital management. Its main operations include the routine management of the Inner Mongolia science and technology venture fund and the fund's risk compensation for the transformation of scientific and technological achievements.

In 2008, it was certified as the first venture capital management company by the Ministry of Science and Technology and received support from the venture capital guidance fund risk subsidy program. In 2011, it was registered with the Autonomous Region Development and Reform Commission as a venture capital management institution. In recent years, the platform has increased its investment in scientific and technological research and development, and since 2016, its independently developed science and technology finance cloud service platform, science and technology insurance service system, science and technology factor service system, and science and technology finance cooperation system have all obtained software copyrights.

The platform serves small and medium-sized enterprises, banks, and investment institutions. It integrates the resources of science and technology financial services to achieve resource sharing, business synergy, tool innovation,

and efficiency improvements, effectively solving the problems of information asymmetry⁷⁰, narrow financing channels, and complex lending procedures between the government, enterprises, and financial institutions, contributing to the promotion of science and technology in Inner Mongolia and facilitating the transformation and industrialization of scientific and technological achievements.

Since 2017, the Autonomous Region Department of Science and Technology has launched special lending services based on the secured financing system for scientific and technological achievements, investing 10 million yuan in risk compensation and deploying specific services through the platform.

Since pilot operations began in 2017, over the four years up to 2021, the platform has signed cooperation agreements with more than 30 institutions, including 22 banks, 5 guarantee companies, and 4 appraisal firms within the autonomous region, establishing a comprehensive service platform for financing scientific and technological achievements. It has completed a total of 235 cases of secured financing for scientific and technological achievements, supporting 169 companies. The use of 100 million yuan of risk compensation funds for financing scientific and technological achievements induced a total of 3.258 billion yuan in bank credit and 2.634 billion yuan in loans being issued.

Under the coordination of the platform, the Bank of China, China Construction Bank, Bank of Inner Mongolia, and JinguBank established branches to pilot science and technology financing. Among the leagues (an administrative unit in Inner Mongolia) and cities, Baotou City established the first pilot branch as a specialized service institution for science and technology finance. Everbright Bank, Postal Savings Bank, SPD Bank, and others have developed financial products for science and technology. Due to their fast lending speed, low interest rates, high success rate, and strong risk avoidance capability, they have been well received by enterprises and science and technology departments in the leagues and cities.

(2) Cooperative Relationships

The platform's partners are mainly professional institutions such as industry associations, similar government and private funds, accounting, legal, and intellectual property rights agencies.

Industry associations include the Inner Mongolia Stock Investment Industry Association and the Inner Mongolia Productivity Promotion Association. The main areas of cooperation with industry associations are the standardization of governance for small and medium-sized enterprises, improvement of modern corporate systems, and support for access to capital markets. Furthermore, efforts are being made to build a delivery base for high-end management and financial talents within the autonomous region, discover and cultivate management talents and innovation and entrepreneurship talents, cooperate with Peking University's business school, Zongheng School of Management, or independently cultivate entrepreneurship and innovation talents, with at least 1000 individuals in the science and technology finance industry provided this support annually.

Similar funds include government funds such as the Inner Mongolia Cooperative Innovation stocks Investment Fund (fund size 800 million yuan), Inner Mongolia People's Investment Management Co., Ltd. (fund size 1.3 billion yuan) and private funds such as Inner Mongolia Zhonglian Times Capital (fund size 500 million yuan).

Cooperation with government funds mainly involves information sharing and project cooperation to realize

⁷⁰ Information asymmetry: Situations where the parties involved in a transaction have different information.

the rapid development goals of science and technology-type and double innovation projects (enterprises) in the autonomous region, accelerate strategic plans such as promoting industrial upgrading, and collect factors of cooperation models such as technology, talents, information, capital, and mechanisms through stock investment, based on complementing each other's strengths.

Collaboration with accounting, legal, and intellectual property rights agencies mainly involve reducing financial and legal risks through professional support and services provided by experts such as lawyers.

(3) Achievements and Areas of Expertise

Patents and scientific and technological achievements are means for companies to compete in the market and are intangible assets formed after significant investment in technological research and development. Financing through intangible assets such as patents and other scientific and technological achievements to ease difficulties around high-value loans for companies is a key advantageous field for the development of the Inner Mongolia Science and Technology Financing Comprehensive Service Platform. The model of financing through scientific and technological achievements effectively promotes the economic transformation and upgrading of the autonomous region, facilitates the transfer and transformation of scientific and technological achievements within the autonomous region, and strongly supports the economic and social development of the autonomous region.

Banks currently cooperating with the platform include the Bank of China, Industrial and Commercial Bank, Construction Bank, Agricultural Bank, Bank of Communications, Postal Savings Bank, Industrial Bank, Everbright Bank, Hua Xia Bank, China Merchants Bank, Minsheng Bank, Bank of Inner Mongolia, Saihan Jingu Rural Bank, Helingeer County Rural Credit Cooperative, Ruyi Haoyin Rural Bank and others. The current science and technology financial products on sale include policy science and technology financial products and commercialized science and technology financial products, etc. Lending methods include credit guarantee, mortgage, and security, etc. For example, the science and technology loan financial product launched by Saihan Jingu Rural Bank has a minimum interest rate of 6.7% per annum, a maximum period of 12 months, and a maximum amount of 9 million yuan, with lending methods including mortgage, collateral, and guarantees, among others.

From 2017 to the end of 2021, in the model of direct financing (excluding equity financing) for scientific and technological achievements, a total of 99 companies were supported, with 191 scientific and technological achievements financed, inducing a total of 2.85 billion yuan in bank credit, and lending a total of 2.22 billion yuan.

(4) Success Stories

"錫林郭勒盟羊羊牧業股份有限公司 smart breeding project with an annual output of 100,000 sheep for consumption"

The construction of this project is organized around Inner Mongolia Sheep Supply Chain Management Co., Ltd, located in Sonid Right Banner (錫林郭勒盟蘇尼特右旗), Inner Mongolia Autonomous Region, with a total investment of 229 million yuan, an annual output of 100,000 sheep for consumption, divided into two phases, with 122.82 million yuan invested in the first phase and 106.14 million yuan in the second phase, and a construction period from April 2022 to December 2024. The project mainly involves the construction of sheep breeding, feed processing, organic fertilizer processing, and other breeding-related facilities for sheep for consumption.

The goal of this project is to build a leading smart breeding base in the autonomous region, applying combined technologies and customized innovations for the breeding industry in terms of scientific and technology innovation, such as 5G + environmental data monitoring, 5G + big data analysis, 5G + high-definition image recognition, 5G +

robot remote control, etc.

Artificial intelligence (AI) technology is integrated with data collection and monitoring to enable intelligent analysis and decision-making on the farm, and new technologies such as automatic feeding, automatic watering, automatic manure and urine cleaning, automatic disinfection, automatic adjustment of sheep shed environments, automatic monitoring of sheep body temperature, and intelligent management of breeding processes are being comprehensively applied.

Through the mediation of the Inner Mongolia Science and Technology Financing Comprehensive Service Platform, a basic loan agreement was signed with the Inner Mongolia Branch of the Bank of Communications, with an initial loan amount of 30 million yuan, a period of 3 years, an annual interest rate of 3.7%, and credit guarantees provided by the platform.

(5) International Cooperation

Currently, the platform does not have many international cooperation projects, but one example is its Science and Technology Innovation Method Dissemination and Application Base jointly constructed with the National Technological Innovation Method and Tool Engineering Technology Research Center of Hebei University and St. Petersburg Polytechnic University in Russia. The base is an international academic exchange hub for industryuniversity-research collaboration, aiming to accelerate the transformation of scientific and technological achievements and the industrialization of high-tech achievements through the integration of knowledge innovation and technology innovation.

(6) Challenges and Development Goals

Currently, the platform is mainly managed by the Science and Technology Financial Service Center of the Autonomous Region Department of Science and Technology, fulfilling a role of providing science and technology financial services. The staff, being part-time or temporarily transferred, generally lacks financial professional service experience in science and technology management and lacks expertise in policy conception and implementation, affecting the promotion effects of related business.

Although the platform aggregates multiple resources from the government, enterprises, financial institutions, and intermediary institutions, related data has not yet been compiled. For example, it is difficult to obtain data from the industrial and commercial, administrative, and bank credit systems for enterprise evaluation, and it is difficult to coordinate with venture capital institutions targeting science and technology-type small and medium-sized enterprises because they are not under the management of science and technology departments.

Currently, the platform's business mainly focuses on implementing higher-level policy documents and building communication channels between financial institutions and enterprises, but it aims to produce market-oriented development in the future.

It needs to strengthen collaboration and information sharing with departments such as industry and commerce, taxation, justice, environmental protection, and quality supervision, and cooperate with other credit investigation institutions, build a big data sharing platform for credit information, construct a credit evaluation system applicable to science and technology-type small and medium-sized enterprises, and enhance its assessment of the work they do.

Furthermore, it should strengthen tracking surveys of enterprise development through big data analysis, continuously conduct tracking surveys and analyses of science and technology-type micro and small enterprises in the

autonomous region and introduce sciento-technometrics⁷¹ to measure and analyze the technological achievements and development status of enterprises, serving as a reference for financial institutions' investments.

4.6 Patent Agencies

4.6.1 CCPIT Patent and Trademark Law Office ("中国国际贸易促进委员会专利商标事务所")

(1) Organizational Structure and Overview

Established in 1957, the CCPIT Patent and Trademark Law Office is the oldest intellectual property rights office in China and is the largest in scale out of China's comprehensive intellectual property rights offices. Its initial registered capital at the time of establishment was 160 million yuan, and its revenue in 2021 reached 2.7 billion yuan. In 2020, to promote its expansion and professional operations, the China Council for the Promotion of International Trade's Asset Management Center initiated the transformation into a limited company that would operate related businesses as an independent legal entity through incorporation, raising the registered capital to 2.9 billion yuan. It has 213 patent attorneys, 60 trademark agents⁷², and 106 legal professionals. It provides services such as consulting, application, mediation, administrative protection, litigation, etc., in related fields of intellectual property rights such as patents, trademarks, copyrights, domain names, trade secrets, designs, etc., to domestic and foreign clients.

The office is headquartered in Beijing and has branches in New York, Silicon Valley, Tokyo, Madrid, Hong Kong, Guangzhou, Shenzhen, and Shanghai.

According to the provisions of Article 19 of the Patent Law (where any foreigner, foreign enterprise or other foreign organization having no habitual residence or business office in China applies for a patent, or has other patent matters to attend to, in China, he or it shall appoint a patent agency designated by the patent administration department under the State Council to act as his or its agent), the patent administration department of the State Council has designated the office as a patent agency for foreign-related matters. On August 17, 2022, the Beijing Municipal Science and Technology Commission, the Zhongguancun Science and Technology Park Management Committee, and the Beijing Development and Reform Commission issued the "Notice on the Announcement of the List of Beijing Technology Advanced Service Enterprises Certified in 2022", selecting the office as a technology advanced service enterprise of Beijing.

(2) Cooperative Relationships

In terms of external cooperation, the office has signed cooperation agreements with intellectual property rights management departments in 17 provinces and cities, including the Beijing Municipal Intellectual Property Office, to conduct exchanges and cooperation on the protection and application of intellectual property rights. It has also signed memorandums of cooperation on trademark and patent protection and the formulation of industry standards with the

⁷¹ Sciento-technometrics: An academic field that encompasses both scientometrics and technometrics, with its methodology fundamentally not differing from scientometrics but rather expanding and extending it in terms of research content and scope.

⁷² Trademark agents: Individuals who work in trademark agency organizations, including service agencies registered by the industrial and commercial administrative departments and law firms engaged in trademark agency business, which are registered with the National Intellectual Property Administration.

China Association of Private Science and Technology Industrialists, the China Chamber of International Commerce, the Capital Intellectual Property Services Association, the China Council for the Promotion of International Trade Commercial Industry Committee, etc., deepening business cooperation by leveraging each other's resource and capability advantages Furthermore, it jointly promotes the standardization of services in intellectual property rights business and the international standardization of these standards, contributing to the mutual development of intellectual property rights and standardization.

(3) Achievements and Areas of Expertise

The office specializes in the protection and operation of patents, handling patent strategy planning, pre-application searches, preparation and execution of patent applications, patent infringement analysis, patent invalidation confirmations, and judicial litigation. It boasts specialized and powerful execution teams in areas such as dispute resolution, information support, patents, and trademarks.

The dispute resolution team includes experts from the patent litigation department, legal department, and trademark & copyright litigation department. The dispute resolution team provides various services to domestic and international clients in fields such as patents, trademarks, copyrights, computer software, integrated circuit layout designs, new plant varieties, trade secrets, domain names, anti-unfair competition, and customs protection. Every year, the dispute resolution team handles hundreds of intellectual property rights administrative litigation and civil infringement cases.

The patent team covers a comprehensive range of technical backgrounds including machinery, electricity, chemistry, and biopharmaceuticals, and has built long-term cooperative relationships with domestic and international companies, including those in the Fortune 500. Its patent agents have an average of 15.6 years of practical experience, and 157 are qualified as patent litigation agents.

Its trademark agents average 16 years of service, with 46 qualified as trademark litigation agents. As one of the earliest established trademark agent departments in China, it has been representing foreign clients' trademark applications since 1957.

(4) International Cooperation

The office organizes a series of large-scale international intellectual property forums, seminars, and overseas study tours to promote international exchange on intellectual property rights in China. In 1973, China affiliated with the World Intellectual Property Organization, later joined the International Association for the Protection of Intellectual Property (AIPPI) and the Licensing Executives Society (LES), and established the AIPPI China Branch and LES China Branch, in which the office plays a vitally important role. Furthermore, commissioned by the Japan External Trade Organization (JETRO), it collaborates with China's customs, industrial and commercial departments, and quality supervision departments to hold seminars on anti-counterfeiting measures and rights protection, enhancing the exchange and cooperation between Japanese enterprises and Chinese anti-counterfeit enforcement agencies, playing a significant role in promoting exchange between Japan and China in the field of intellectual property rights.

(5) Challenges and Development Goals

With the continuous implementation of national and local intellectual property strategies, there is an increasing need for innovation carriers for services related to patent analysis, patent litigation, patent invalidation, standardization of intellectual property management, support for provincial and municipal intellectual property strategy projects, and cultivation of high-value patents. The office is expanding its services to meet market needs, improving the service platform for innovation entities, and increasing investments in patent search and analysis, litigation, and results transformation services to meet the diverse needs of these carriers.

4.6.2 Jinan Shengda Intellectual Property Agency Co., Ltd. (济南圣达知识产权代 理有限公司)

(1) Organizational Structure and Overview

Jinan Shengda Intellectual Property Agency Co., Ltd. (Jinan Shengda) was established in 2004. Its predecessor was the Patent Office of Shandong University. As well as being a patent agency approved by the National Intellectual Property Administration, it is also a trademark agency reported to and registered with the National Intellectual Property Administration's Trademark Office. It was also one of the first agencies in Shandong Province to be approved for foreign-related patent business by the National Intellectual Property Administration.

After nearly 18 years of development, Jinan Shengda has evolved into a comprehensive intellectual property service organization that integrates domestic and foreign patent and trademark representation, copyright representation, patent information analysis, patent navigation, patent layout, intellectual property rights maintenance, litigation, high-tech enterprise applications, and science and technology project consulting, serving as a public service demonstration platform for small and medium-sized enterprises in Shandong Province.

Jinan Shengda is headquartered near the Qianfo Shan Campus of Shandong University in Jinan, with branches in Jinan Innovation Zone, Qingdao, Tai'an, and other locations. The company has more than 150 staff members, including a professional and technical team of 85 people with bachelor's degrees or above. The staff includes research fellows, associate research fellows, senior engineers, patent agents, trademark agents, and lawyers. The company's registered capital is 1 million yuan, and its revenue in 2021 reached 39.9 million yuan, achieving growth for three consecutive years.

(2) Cooperative Relationships

Currently, the company has long-term service contracts with more than 1,000 organizations, covering various fields such as government, enterprise, academia, research, and various key points in the industrial chain for the transformation of scientific and technological achievements. Famous enterprises and business organizations which it has long-term service contracts with in Shandong Province include Shandong University, China University of Petroleum, Qingdao Technological University, Shandong University of Science and Technology, State Power Investment Corporation (Shandong), State Grid (Shandong), Shandong Academy of Agricultural Science, Qilu Hospital, Hoteam Software, among others.

(3) Achievements and Areas of Expertise

As of July 2022, 65 of the patent cases participated by Jinan Shengda have won national, provincial, and municipal patent awards, including 22 China Patent Awards. The well-known domestic intellectual property evaluation organization, IPRDaily, in collaboration with Patsnap, used big data analysis of patents to select the top 10 industries such as artificial intelligence, new energy vehicles, industrial robots, blockchain, graphene, etc., and identify the top 10 patent agencies and outstanding patent agents contributing to innovation. Jinan Shengda ranked 8th nationwide in the fields of new

energy vehicles and graphene, and Zhang Yong, the deputy general manager of the company, ranked 2nd nationwide in the field of industrial robots.

(4) Success Stories

Case 1: Himin Solar Energy Case

In April 2015, Beijing Huanneng Haichen Technology Co., Ltd submitted a patent infringement processing request to the Shandong Provincial Intellectual Property Office, demanding that Himin Solar Co., Ltd. pay hundreds of millions of yuan in patent infringement compensation. As the agent of Himin Solar Energy, Jinan Shengda conducted professional analysis and comparison and confirmed that it had not infringed on any rights. In the subsequent infringement litigation, Jinan Shengda argued based on facts, and the judgment of the Shandong Provincial Intellectual Property Office supported Jinan Shengda's view, confirming that Himin Solar Energy did not infringe the rights.

In August 2015, Beijing Huanneng Haichen Technology Co., Ltd filed a lawsuit with the Jinan Intermediate People's Court, challenging the decision, but once again the court confirmed that Himin Solar Energy did not violate any laws, avoiding an expensive payout for infringements.

Case 2: Fengxiang Group's Trademark Registration

On January 15, 2019, Jinan Shengda, commissioned by Shandong Fengxiang (山東鳳祥), filed an objection to the trademark "Shuangfengxiang SF and its derivatives," and succeeded, protecting the company's legitimate rights and interests. Shandong Fengxiang is one of China's largest broiler production, processing, and export enterprises, a national key leading enterprise in agricultural industrialization, and also one of the top 10 enterprises in China's food safety.

The "Fengxiang" (鳳祥) brand of the company is recognized as a famous trademark in China and has a high standing and influence in the field of meat-based food products. In 2017, Jinan Shengda provided trademark monitoring services to Shandong Fengxiang Company, during which it was discovered that the trademark "双鳳祥SF 及図" brand had passed the preliminary examination of the Trademark Office in multiple categories. This trademark is very similar to the "鳳祥" trademark owned by Shandong Fengxiang, significantly infringing the legitimate rights and interests of Shandong Fengxiang. Jinan Shengda, commissioned by Shandong Fengxiang, filed an objection to this trademark, and the Trademark Office made a decision to reject the registration.

(5) International Cooperation

Jinan Shengda has established long-term and stable business partnerships with well-known offices in the United States, the European Union, Japan, Australia, South Korea, Russia, etc., providing one-stop global intellectual property services to domestic and foreign clients.

(6) Challenges and Development Goals

Currently, the main problem hindering the development of enterprises is the lack of comprehensive and in-depth services and a single service models. In recent years, the needs of enterprises have begun to shift from low-end to middle and high-end. For example, new high-level needs such as intellectual property strategy analysis, planning, drafting, risk assessment, infringement warning, intellectual property entrusted management, intellectual property participation-type commercialization, and patent layout have emerged. Particularly powerful enterprises have begun

to seek full-set, comprehensive services related to intellectual property, even for rights acquisition agency services. Furthermore, companies are showing greater interest in the selection of rights subjects and the protection of rights after acquisition, as well as the pursuit of specific economic benefits through intellectual property rights. Jinan Shengda is still in an exploratory stage regarding this point, actively searching for operational models to conduct related business.

Next, the creation of intellectual property rights requires that the company set goals for their creation, track related technological development trends, and participate in research and development projects, etc., to seek out valuable high-level, valuable innovations from the sources of innovation, maximize the value of intellectual property rights protection, and seize advantageous opportunities in market competition.

4.7 Science and Technology Evaluation Organizations

4.7.1 Qingdao Science and Technological Achievements Standardization Evaluation Service Platform ("青岛科技成果标准化评价服务平台")

Organizational Structure and Overview

The Qingdao Science and Technological Achievements Standardization Evaluation Service Platform (Qingdao Service Platform) was established in 2015 under the Qingdao Municipal Science and Technology Bureau, with a registered capital of 1.2 million yuan and currently has 27 staff members.

On July 15, 2014, the National Office for Science and Technology Awards published the "Opinions on the Implementation of the Second Phase of the Science and Technology Achievements Evaluation Pilot Activities" ("关 于开展二期科技成果评价试点工作的实施意见"), announcing 15 pilot organizations. Among them, the Qingdao Service Platform was the only science and technology achievements standardization evaluation organization among economically independent (from provincial government) cities⁷³. Based on the "General Rules for the Evaluation of Scientific and Technological Research Projects" ("科学技术研究项目评价通则") and related regulations, it established a system of expert consulting and third-party information analysis for the evaluation of scientific and technological achievements. Generally, Science and Technology Evaluation Organizations compile evaluation reports on science and technology achievements, report them to industry associations for approval, stamp them with a special stamp for the evaluation of these achievements, and register them.

Since its establishment in 2015, a complete management process for the evaluation, registration, award, and transaction of scientific and technological achievements has been established. The award rate of standardized evaluations of scientific and technological achievements (such as the National Science and Technology Awards) has reached 54%, and technology transaction evaluation projects have been listed and traded on the city's technology transaction market, with a listed transaction amount reaching 857 million yuan.

The main work currently conducted by the Qingdao Service Platform is as follows:

1. Establishment of an expert consultation system for the evaluation of scientific and technological achievements

⁷³ Refers to Dalian, Qingdao, Ningbo, Xiamen, and Shenzhen.

A system for consulting with experts in relevant fields for the evaluation of scientific and technological achievements has been introduced. The evaluation of scientific and technological achievements requires a technical advisory expert group consisting of experts from fields or industry. The tasks of this group include supporting the formulation of evaluation plans, reviewing technical reports, technical credentials, third-party information analysis reports, third-party inspection and test reports, and creating and issuing technical expert advisory opinions. The evaluation report requires confirmation through being signed by the group leader.

2. Construction of a third-party information analysis system for scientific and technological achievements

A third-party information analysis system has been introduced for the evaluation of scientific and technological achievements. According to the "Management Measures for Scientific and Technology Innovation Organizations" ("科技查新机构管理办法"), scientific and technology novelty investigation organizations accredited by government departments with jurisdiction over science and technology conduct analysis of third-party information on innovations in scientific and technological achievements based on the requirements of the "Scientific and Technological Novelty Investigation Regulations" ("科学技術查新規範")⁷⁴, mainly analyzing and evaluating the level of innovation of the achievements and comparing them with reference data.

3. Actively promote third-party inspections and tests

The platform actively promotes third-party testing and inspections for the evaluation of scientific and technological achievements, introduces third-party testing and inspection organizations, tests and analyzes the scientific and technological achievements to be evaluated, and creates and issues tests and inspection reports from an impartial and authoritative stance according to related regulations, standards, or contracts. Needs for the evaluation of scientific and technological achievements are mainly divided into evaluations related to the management of scientific and technological achievements, evaluations related to research management, and evaluations related to technology transactions.

Evaluations classified as management of scientific and technological achievements are used for the evaluation of achievements and the marketing and promotion of new products and are classified under the category of postevaluation. Evaluations related to research management are used for the initiation, supervision, and inspection of research projects, becoming part of process management. Evaluations related to technology transactions are used for the evaluation of technology sales and purchases, the valuation of shares in scientific and technological achievements, and financing.

To evaluate scientific and technological achievements based on various categories, evaluation regulations are established tailored to needs. Evaluations related to the management of scientific and technological achievements are mainly divided into evaluations of natural science achievements, applied research achievements, and soft science achievements. Evaluations related to scientific research management are mainly divided into evaluations related to the initiation of scientific research projects, the supervision of scientific research projects, and the completion and inspection of scientific research projects. Technical transaction evaluations are mainly divided into evaluations of the sale of technical achievements, conversion of technical achievements into stocks, and evaluation of collateral for financing technical achievements. Due to the differences in industries and fields of scientific and technological

⁷⁴ The "Scientific and Technological Novelty Investigation Regulations" ("科学技術查新規範") issued by the Ministry of Science and Technology in December 2000 explains the concept of "novelty" and the key points of content to be proved.

achievements, industry and field-specific evaluation criterion systems have been constructed in the four major fields of biotechnology, new materials, equipment manufacturing, and electronic information, and evaluation organizations construct evaluation criterion systems for further subdivided industries and fields according to their expertise.

(2) Cooperative Relationships

The Qingdao Service Platform has established wide-ranging collaborations with many leading inspection and testing institutions in the introduction of third-party testing and inspection institutions. Including Qingdao Zhongtian Zhicheng Technology Service Platform (biopharmaceutical, new materials, electronic information, civil engineering), it has signed agreements for inspection and testing cooperation with 42 inspection and testing institutions, 26 of which have a track record of cooperation.

Representative cooperating institutions include: Qingdao Smart Agricultural University Technology Service Co., Ltd (biopharmaceutical, new energy & energy saving, agriculture, forestry, fisheries & livestock, chemistry & chemical industry), Qingdao Benzhen Technology Information Consulting Co., Ltd (innovation & entrepreneurship & incubation: provision of basic services, scientific and technological services, and investment and financing services), Qingdao Huaruiyuan Technology Co., Ltd (biotechnology, forestry, electronic information technology, new energy, new materials), Qingdao Liancheng Innovation Technology Development Service Co., Ltd (biotechnology, pharmaceutical manufacturing, machinery manufacturing), and Qingdao Haida Xinxing Computer Engineering Center (electronic information, high-tech services, high-tech transformation).

Furthermore, to promote innovative work amongst scientific and technological achievements, it has conducted multifaceted cooperation with organizations such as the Ministry of Education's Scientific and Technological Innovation Station, Shandong Provincial Science and Technology Information Institute Innovation Station, China University of Petroleum (East China) Library, Qingdao Science and Technology Information Research Institute, Shandong University of Science and Technology Library Innovation Center, in aspects such as the planning of scientific and technological projects, the appraisal of scientific and technological achievements, notification of awards for achievements, patent applications, and academically proven novelty.

(3) Achievements and Areas of Expertise

Since the Qingdao Service Platform's establishment in 2015, it has implemented standardized evaluation services for scientific and technological achievements, expert consulting services, and third-party information analysis services. These are its areas of expertise, especially the standardized evaluation services for scientific and technological achievements, in which it holds a leading position in the industry in Qingdao City and even in Shandong Province. The standardized evaluation service system for scientific and technological achievements mainly evaluates and analyzes achievements in cooperation with partner institutions from the dimensions of the technical maturity of the achievements, the degree of technological innovation of the achievements, the evaluation of the technical advancement of the achievements, and effect and benefit analyses of the scientific and technological achievements in a scientific and objective manner.

Since its establishment in 2015, the Qingdao Service Platform has completed 3,737 evaluations of scientific and technological achievements submitted by 687 organizations. These evaluations were concentrated in the fields of biopharmaceuticals, new materials, agriculture, forestry, fisheries and livestock, advanced manufacturing, and new energy & energy saving, etc.

(4) Success Stories

On November 24, 2014, commissioned by China Aviation Research Institute, it conducted an evaluation on the research, manufacturing, and industrial application of high-performance low-altitude unmanned airships. The main purpose of this evaluation was to facilitate the application for awards for this achievement, with experts providing support to understand the value of the achievement.

The Qingdao Service Platform, in accordance with the national standard "General Rules for the Evaluation of Scientific and Technological Research Projects" ("科学技术研究项目评价通则") and the related standard evaluation methods issued by the Qingdao Municipal Science and Technology Bureau, conducted the investigation and analysis of the achievements to be evaluated based on the principles of independence, objectivity, and fairness, publishing them in a report. This achievement is expected to be used in experimental or commercial airships in the aerospace field in the future. It also adopts new principles and makes use of patents with independent intellectual property rights Further innovation was achieved in terms of technological improvements and process and structural optimizations, achieving a reduction in system weight and operational efficiency losses.

(5) International Cooperation

According to the "Notification on Minor Policy Measures to Strengthen Science and Technology and Lead and Accelerate the Construction of an International Innovation-oriented City" issued by the Qingdao Municipal Government ("关于强化科技引领加快推进国际化创新型城市建设的若干政策措施的通知"), the Qingdao Service Platform, as a business organization affiliated with the Qingdao Municipal Science and Technology Bureau, is actively participating in international cooperation in the field of scientific and technological innovation.

In 2020, the "Qingdao International Innovation and Entrepreneurship Contest" saw participation from 60 project teams from countries such as the United States, Canada, Germany, Italy, the United Kingdom, Israel, Russia, Japan, and South Korea. It was commissioned by the Qingdao Municipal Science and Technology Bureau and co-hosted by the platform with the China Association for International Science and Technology Cooperation⁷⁵. As a co-organizer and partner of the contest, the Qingdao Service Platform engaged in exchanges of international cooperation with teams from various countries before and after the competition.

The Platform also participated in the planning and construction of projects such as the Shanghai Cooperation Organization Technology Transfer Center, Chinese-German Young Scientist Academy Project, and Qingdao Chine-Japanese Science City Project. Commissioned by the Qingdao Municipal Science and Technology Bureau, the Qingdao Service Platform has engaged in exchanges with the Russian Academy of Engineering, Moscow State University, Rostov Chamber of Commerce and Industry, Korea SMEs and Startups Agency, Germany's Siemens, and Japan's University of Tsukuba, and has signed strategic cooperation agreements on the evaluation of scientific and technological achievements with the Russian Academy of Engineering and the Korea SMEs and Startups Agency.

⁷⁵ The China Association for International Science and Technology Cooperation ("中国国际科学技术合作协会"), established in February 1992, is a non-profit organization with corporate status jointly established by the Ministry of Science and Technology, the Chinese Academy of Sciences, the Chinese Academy of Engineering, the China Association for Science and Technology, and the National Natural Science Foundation of China, promoting international scientific and technological exchanges and cooperation.

(6) Challenges and Development Goals

(1) The necessity of developing basic reinforcement methods and tools

The current lack of basic evaluation methods and tools in the scientific and technological achievements evaluation system within the Qingdao Service Platform is a significant constraint on the development of scientific and technological evaluation. Therefore, promoting the standardization of scientific and technological evaluation and enhancing the professionalism and standardization of scientific and technological evaluation in the future is the platform's main goal.

In 2016, the Ministry of Science and Technology, the Ministry of Finance, and the National Development and Reform Commission jointly issued the "Regulations on Scientific and Technological Evaluation Activities (Trial)" ("科技评估工作规定(试行)"). According to the requirements set forth by the state and in light of the actual situation in Qingdao, the Qingdao Service Platform drafted the "Qingdao Scientific and Technological Project Evaluation and Review Action Guidelines (Trial)" in 2017, focusing on scientific and technological evaluation activities. They aimed to (1) build a sound scientific and technological evaluation system, (2) to promote the scientific and standardized operation of scientific and technological evaluation activities in Qingdao, providing a practical foundation, (3) to strengthen the standardization and systematization of project management process services, establishing a risk prevention and control mechanism for the process management of scientific and technological projects, (4) to standardize the management of evaluation, tracking, inspection, and acceptance of commissioned scientific and technological projects at key points.

(2) Diversification and quantification of scientific and technological achievements

Developing methods for evaluating the diversification and quantification of scientific and technological achievements is another direction for the future development of the Qingdao Service Platform.

The development of scientific and technological evaluation methods is a continuous development and improvement process. Currently, the methodologies used by the Qingdao Service Platform for scientific and technological evaluation are still undergoing continuous research and exploration. In the future, greater emphasis is expected to be placed on the diversification of evaluation methods, such as using different evaluation methods for each scientific and technological project. For example, basic research projects, applied research projects, and development research projects need to use different evaluation models. Basic research projects should be based on the principle of academic impact, relying on the number of citations by scholars in the same field and whether they are extracted in internationally authoritative abstracts. Applied research and development research projects need to approach patent management according to market value.

4.7.2 Henan Zhongchuang Technology Evaluation Institute ("河南省中创科技评价研究院")

(1) Organizational Structure and Overview

The Henan Zhongchuang Technology Evaluation Institute (Zhongchuang Research Institute) was established in March 2019 with a registered capital of 1 million yuan and is located in Zhengzhou City. It currently has a staff of 43 people, including 3 professor-level senior engineers and 6 professor-level experts. It also cooperates with universities such as Henan Agricultural University and Henan University of Technology and has over 100 part-time external professors. In 2022, commissioned by the government and different enterprises, it completed 78 evaluations of scientific and

technological achievements, with the amount of scientific and technological achievements evaluations it completed reaching more than 69 million yuan. It also directly and indirectly promoted the signing of scientific and technological achievements utilization contracts, which reached 125 million yuan on a contract amount base.

The Institute is an authoritative institution specializing in third-party evaluation of scientific and technological achievements, established under the guidance of national policies and accredited by relevant departments of Henan Province. Accredited by the science and technology departments and education departments of the province and city, it mainly engages in the evaluation of scientific and technological achievements, the transfer and transformation of scientific and technological achievements, and the evaluation and matching of scientific and technological talents.

Zhongchuang Research Institute encompasses the Scientific and Technological Achievements Evaluation Center, Talent Evaluation Center, Scientific and Technological Achievements Transformation Center, Zhongchuang Talent Management Center, Scientific and Technological Finance Investment and Financing Evaluation Center, Innovation and Entrepreneurship Incubation Center, etc. It is also a technology transfer demonstration organization in Henan Province and a member of the Zhongyuan Technology Transfer Innovation Federation.

The Institute has cooperated with relevant departments of the Ministry of Science and Technology and organizations such as the China National Institute of Standardization to develop indicator systems for the evaluation of scientific and technological achievements and operational procedures for the evaluation of scientific and technological achievements, participating in the drafting of many national standards related to the evaluation of scientific and technological achievements.

(2) Cooperative Relationships

It has signed cooperation agreements with universities and enterprises such as Zhengzhou University, North China University of Water Resources and Electric Power, Henan Agricultural Agency Technology Development Center, Henan Province Puffed Food Inspection and Testing Center, Henan University of Technology, Zhengzhou Institute of Science and Technology, Zhengzhou Shengda University, Henan Fengzhihuang Industrial Co., Ltd, Henan Huamao Junjie Car Co., Ltd, Henan Demeng Medical Technology Co., Ltd, and has developed business related to the evaluation and transformation of scientific and technological achievements and talents.

(3) Achievements and Areas of Expertise

Zhongchuang Research Institute has assembled a team of over 100 high-level authoritative experts from universities and research and development institutions in Henan Province. It provides full-chain services including the completion of scientific and technological achievement evaluation materials, scientific and technological novelty investigations, inspection and testing, registration of scientific and technological achievements, guidance for national award and national plan applications, capital matching, and technology transfer. It has accumulated extensive experience in the fields of evaluation services, administrative services, and scientific and technological novelty.

In terms of its evaluation services, these are conducted according to the principles of scientificity and objectivity, mainly focusing on academic value, economic effect, and social impact. Different emphases are placed on different categories of achievements, but it avoids biased approaches. For basic research achievements, the focus is placed on academic value, while for technological research achievements (applied research through to development research achievements), the focus is on economic effect and social impact. Its basic process of evaluation includes a formal review of evaluation materials, the signing of an evaluation contract, the selection of evaluation experts, the holding

of the scientific and technological achievements evaluation meeting, and the creation and delivery of the scientific and technological achievements evaluation report.

The evaluation results by Zhongchuang Research Institute can be registered as national scientific and technological achievements and serve as important supplementary material for recommending the National Science and Technology Award⁷⁶. It also reduces the communication and negotiation costs between buyers and sellers in technology transactions, improves transaction efficiency, and can achieve acceptance from investors and partners, serving as an important criterion for judging the value of achievements when seeking investment, licensing, transfer, or cooperation.

In terms of administrative services, the Institute helps build the city's scientific and technological innovation service system, accelerates the collection and transfer of innovation resources, cultivates innovation-type enterprises, and conducts evaluations of scientific and technological achievements commissioned by government departments, thereby promoting the sustainable development of the city's scientific and technological innovation.

The scientific and objective evaluations it provides enable the deployment of financial and tax support for companies' technological innovation activities.

"Scientific and technological novelty" means that the innovating agency verifies the innovation of the scientific and technological content provided by the requester of the investigation, operates according to the "Scientific and Technological Novelty Investigation Regulations," and concludes by conducting literature searches and comparative analyses. Confirming scientific and technological novelty is an important foundational work in activities such as scientific research, product development, and scientific and technological management.

It combines literature searches with research and investigation of information, using literature as the basis, literature searches and research and investigation of information as means, detected results as the basis for a comprehensive analysis to conduct informational reviews on the novelty of innovation projects, compiling an innovation report that has a solid basis, analysis, and comparative conclusions.

In other words, novelty investigations involve detecting objective facts from literature and drawing conclusions about the novelty of the concept in question. Therefore, novelty investigations have strict regulations regarding their duration, scope, and procedures, requiring completeness and accuracy, and must produce clear conclusions. The conclusion that a finding is novel must be objective and verifiable. however, these are not conclusions based on a comprehensive evaluation and review of achievements. That kind of evaluation is not obtainable through simple literature searches, making this process distinct from expert reviews.

Scientific and technological novelty investigating applies to the following activities: (1) Applications for the National Technology Invention Award and National Science and Technology Progress Award, (2) applications for national high-tech research and development programs such as 863⁷⁷ and 973⁷⁸, (3) applications for the National Natural Science Foundation projects, provincial and municipal natural science foundation projects, and general scientific and technological project proposals, (4) inspection, evaluation, and transformation of scientific and technological achievements, (5) transfer of scientific and technological achievements, (6) notification of new products,

⁷⁷ 863 Program: State High-Tech Development Plan (integrated into the National Key R&D Program in February 2016)

⁷⁶ The "National Science and Technology Award" is the highest level of government award in China, established by the State Council. It is awarded annually to individuals or organizations that have made creative contributions in the process of technological research, technological development, technological innovation, the dissemination of applied advanced scientific and technological achievements, the promotion of high-tech industrialization, and the achievement of major scientific and technological projects or plans.

⁷⁸ 973 Program: National Basic Research Program (also integrated)

(7) applications for national invention patents, (8) evaluation of national key laboratories, (9) explanation of doctoral students' research topics, etc. There are also other categories novelty investigation required by other national and local regulations, enterprises, and business organizations.

Novelty investigations provide objective literature-based evidence for the appraisal, evaluation, acceptance, transformation, and encouragement of scientific and technological achievements, ensuring their scientificity and reliability. When performing these activities, without reliable innovation reports from innovation departments based on evidence from literature, relying solely on the expertise and experience of expert groups may not be impartial and might not lead to decisive conclusions. This not only demotivates scientific and technical personnel but also hinders the dissemination and application of achievements. Combining high-quality novelty investigations with extensive expertise from experts can prevent the above phenomena and ensure the authority and scientific validity of appraisal, evaluation, acceptance, transformation, and encouragement.

(4) Success Stories

(1) Project completed by Zhengzhou University and Zhengzhou Gongluo Construction Engineering Testing Co., Ltd On August 19, 2022, following the "Measures on Scientific and Technological Evaluation" ("科学技术评价办法")⁷⁹ issued by the Ministry of Science and Technology and the standards and procedures for scientific and technological achievements evaluation, the Zhongchuang Research Institute, a third-party Science and Technology Evaluation Organization called on relevant experts to evaluate the scientific and technological achievements of a "Core Technology and Application of Ultra-High Toughness Concrete with Recycled Brick Powder" project completed by Zhengzhou University and Zhengzhou Gongluo Construction Engineering Testing Co., Ltd After a comprehensive review by an evaluation committee and unanimous agreement among experts, the research results of the project completed by Zhengzhou University and Zhengzhou Gongluo Construction Engineering Testing Testing Co., Ltd were found to be top-level in China. The project passed the scientific and technological achievements evaluation, with the evaluation committee providing suggestions for improving the project's issues.

(2) Project completed by Nongxin Technology (Beijing) Co., Ltd., and others

On April 25, 2022, the Zhongchuang Research Institute called on relevant experts to evaluate the scientific and technological achievements of the project "Research and Development and Application of Core Technologies for Precision Operations in Smart Farms" completed by Zhengzhou University of Light Industry, Nanjing Agricultural University, Anhui University, and Nongxin Technology (Beijing) Co., Ltd.

After a comprehensive review by an evaluation committee, the project was considered innovative in concept, high in innovation level and practicality, and possessing independent intellectual property rights, reaching the top level domestically and an advanced level internationally in accurate sensing and assessment of crop information in smart farms, as well as autonomous navigation and precise operation technology for agricultural machinery. The project

⁷⁹ The "Measures on Scientific and Technological Evaluation" issued by the Ministry of Science and Technology in November 2003 were established based on regulations such as the "Decision on Improving the Work of Scientific and Technological Evaluation" ("关于改进科 学技术评价工作的决定") jointly issued by the Ministry of Science and Technology, the Ministry of Education, the Chinese Academy of Sciences, the Chinese Academy of Engineering, and the National Natural Science Foundation of China. These regulations aim to standardize scientific and technological evaluation activities, establish a sound mechanism for scientific and technological evaluation, provide proper guidance for the healthy development of scientific and technological evaluation activities and technological evaluation activities and requirements for scientific and technological evaluation activities and the appointment of experts for evaluation.

passed the scientific and technological achievements evaluation, but the evaluation committee made suggestions for improvement.

(3) Project completed by Xuchang University

On March 30, 2022, the Zhongchuang Research Institute called on relevant experts to evaluate the scientific and technological achievements of the project "Core Technology and Application of Industrial Motor Condition Monitoring Based on Cloud-Edge-Terminal Integration" completed by Xuchang University and others.

After a comprehensive review by an evaluation committee, their unanimous view was that the project was innovative, with a rational design, advanced technology, high practicality, independent intellectual property rights, and innovative technology for condition monitoring and evaluation of industrial motors, attaining a leading level domestically. The project passed the scientific and technological achievements evaluation, but the evaluation committee made suggestions for improvement.

(4) Project completed by University for Science and Technology Zhengzhou and Henan Province Intelligent Information Processing Control Engineering Technology Research Center

On December 29, 2021, the Zhongchuang Research Institute called on relevant experts to evaluate the scientific and technological achievements of the projects "Research on the Proliferation Effect of Negative Oxygen Ions in Plants Based on High-Voltage Pulse Electric Fields" and "Monitoring System for Trace Element Content in Crop Growth Processes Based on Big Data" completed by the University for Science and Technology Zhengzhou and Henan Province Intelligent Information Processing Control Engineering Technology Research Center in Zhengzhou.

After a comprehensive review by an evaluation committee, both projects were found to be rationally designed, featuring advanced and practical technology and innovative features, attaining a leading level domestically. However, the expert committee also made suggestions for improvement.

(5) International Cooperation

The Zhongchuang Research Institute actively participates in key special projects related to intergovernmental international scientific and technological innovation cooperation and international joint laboratories by the Ministry of Science and Technology and Henan Province Department of Science and Technology to fully play a leading and demonstrative role in the international scientific and technological cooperation platform, linking with international scientific and technological innovation resources.

Currently, in the field of scientific and technological achievements evaluation, the institute has established strategic cooperation relationships with over ten foreign research and development institutions, including the Israeli Ministry of Agriculture and Rural Development's Volcani Center, Slovenia's JT Business Development Innovation Cooperation Platform, and the International Technology Transfer Cooperation Network (ITTN), planning to implement specific cooperation agreements on the evaluation and application of scientific and technological achievements in particular projects.

(6) Challenges and Development Goals

Currently, the Zhongchuang Research Institute faces challenges such as a relatively small evaluation scale compared to evaluation institutions in Beijing and Shanghai, a shortage of evaluation personnel, and an urgent need to optimize the evaluation environment, which to some extent constrains the development of Science and Technology Evaluation Organizations.

Specifically, the project application documents submitted by the project organizations are not standardized, and there is a lack of understanding of project funding management methods and project application guidelines, leading to deficiencies, non-standard submissions, and irrational budgeting in the submitted documents. The Zhongchuang Research Institute returns all documents that do not meet the application requirements to the project organizations for revision and resubmission to the evaluation institutions after improvements to their completeness.

To effectively improve the standardization and rationality of project organizations' application documents and avoid significant disruptions to the operations of both evaluation and project organizations, it is recommended that management departments organize experts to provide specialized training to project organizations before creating annual project applications.

Based on the requirements of regulations related to the management of scientific and technological plan projects, the number of experts involved in the evaluation and review process of projects is generally set at seven or more, and financial experts are required be qualified as certified public accountants. Located inland, Henan Province faces a relative shortage of specialized personnel, with a relatively small number of technical personnel meeting the conditions required to be evaluation experts and an extreme shortage of experts in some specialized industrial fields, leading to certain difficulties in the recruitment process for project evaluation experts, and in some cases, repeated recruitment due to temporary absence of experts.

Experts participating in project evaluation and review are not fixed, and since the evaluation and review of scientific and technological projects have been conducted online since 2016, some experts are using the institute's key scientific and technological project evaluation system for the first time. Some of these experts are not proficient in operating the system and are unfamiliar with the procedures and scoring criteria for evaluating scientific and technological projects, requiring staff provide explanations before project evaluations.

4.8 Science and Technology Information Service Organizations

4.8.1 Sichuan Institute of Science and Technology Information ("四川省科学 技术信息研究所")

(1) Organizational Structure and Overview

The Sichuan Institute of Science and Technology Information was established in 1959. It is a comprehensive scientific and technological information research and service organization under the jurisdiction of the Sichuan Provincial Department of Science and Technology and is also an industrial corporation⁸⁰ known as the Sichuan High-Tech Industry Financial Services Center. The institute is a national-level scientific and technological novelty investigation consulting organization, as well as the National Science and Technology Library Literature Center Chengdu Service Station, National Technology Transfer Organization, and Sichuan Province innovation method popularization and application base. It also serves as a provincial-level scientific and technological service demonstration institution, Sichuan engineering technology library provincial-level scientific and technological base, and Sichuan Science and Technology Report Management Service Center.

⁸⁰ Industrial corporation: Refers to a legal entity engaged in non-profit activities for the public good, funded by the national budget.

In recent years, the institute has focused on scientific and technological innovation, devoted efforts to building a high-quality Sichuan Province science data and science and technology resources center, and established a highlevel scientific and technological innovation think tank based on factual data, in addition to engaging in scientific and technological innovation services and achievement transformation, striving for a leading position in scientific and technological financial services.

The internal organization of the institute includes a General Affairs Department, Party Affairs Office, Personnel Education Section, Finance Section, General Affairs Service Center, Scientific and Technological Literature Service Center, Scientific and Technological Novelty Investigation Center, Information Research Center, Scientific and Technological Financial Services Center, Platform Management Center, Scientific and Technological Funds Evaluation Service Center, Innovation Service Center, Scientific and Technological Financial Services Center, Scientific and Technological Evaluation Center, Periodical Evaluation Service Center, Innovation Service Center, Scientific and Technological Evaluation Center, Periodical Editorial Department, etc.

The institute has a staff of 196 people, including 32 senior and 76 intermediate professional technicians, making it a strong provincial-level comprehensive scientific and technological information research and service organization within the national scientific and technological information system.

(2) Cooperative Relationships

As a central entity in the regional innovation method dissemination and application service base established by the central government's Ministry of Science and Technology, the institute leverages its resource advantages in innovation among industries, academia, research, and government within the province to conduct research and cooperation on innovation methods, engaging in extensive cooperation and exchanges with various industry associations, academic societies, and financial institutions. Industry associations include the Sichuan Province Science and Technology Information Society, Sichuan Province Innovation Method Research Association, Sichuan Province Science and Technology Periodicals Editing Society, Sichuan Province Invention Association, etc.

As the pace of scientific and technological informatization accelerates, the institute has formed numerous partnerships with related institutions in the field of science and technology, such as the provincial science and technology report service platform, Sichuan Province science and technology literature sharing service platform, Sichuan Province science and technology achievements novelty investigation and consulting service center, Sichuan Province science and technology financial platform, and Sichuan Province science and technology achievements transformation information service platform. These collaborations span technical exchanges, resource sharing, business outsourcing, and information product development in the field of technical information.

(3) Achievements and Areas of Expertise

(1) Technology Economic Policy Analysis

The institute provides services such as project feasibility studies and technology value assessment services, incorporation of domestic and international information, information processing using economic and mathematical models, demonstration and analysis of various technology plans, and final decision-making. It is responsible for projects related to research on the economic and social benefits of the circulation of scientific and technological information, research on the evaluation methods of patent and proprietary technology value, and research on the evaluation indicator system for key projects of scientific and technological research.

(2) Strategic and Planning Research

The institute provides strategy formulation, policy research, and management decision-making services to government departments, research and development institutions, and corporate/business organizations. It also conducts research on key issues such as economic and social development strategies, development plans, industrial structure, reform and opening-up, and regional distribution, offering its decision-making advisory services to local governments, Chinese and foreign companies, and industry associations.

The institute also participates in the formulation of scientific and technological development plans, and research on regional and industrial development. It implements research on regional and industrial development strategies, studying the available talent in and technological foundations of regions and industries and their unique advantages, It also proposes development models, development strategies, and strategic objectives for regions and industries, and providing foundational materials for government development planning.

It has implemented projects such as a construction plan for Chengdu-Deyang-Mianyang national science and technology achievements transfer and transformation demonstration zone, research on Sichuan Province's science and technology development strategy, research on Sichuan Province's tobacco production development strategy, Research on Sichuan Province's nanotechnology development measures, research on the current situation and countermeasures of Sichuan Province's competitive intelligence industry development, and research on an international circular economy development strategy.

(3) Network Information Center

The center forms a comprehensive advantage centered on the development of information resources, data aggregation and analysis, information technology platforms, and teams of specialized personnel. It mainly engages in information construction projects such as system integration, software development, data processing, website construction, and multimedia design and production. The center boasts strong technical advantages and research and development capabilities, along with extensive practical experience and corresponding qualifications, providing professional information network services to the local community.

The center not only operates the institute's website and various information platforms but is also currently responsible for the information editing and daily operation of the Sichuan Province Science and Technology Achievements Transfer Information Service Platform.

(4) Success Stories

Construction Plan for Chengdu-Deyang-Mianyang National Science and Technology Achievements Transfer and Transformation Demonstration Zone

Commissioned by the Science and Technology Achievements Department of the Sichuan Provincial Department of Science and Technology, this plan was created in August 2018, approved by the department, and officially announced on October 1, 2018, under the name of the Sichuan Provincial People's Government.

In the plan, the institute proposed a layout for the demonstration zone as three-in-one with vertical and horizontal integration. "Three-in-one" refers to building a community that covers the transfer and transformation of scientific and technological achievements in Chengdu, Deyang, and Mianyang, centered around Chengdu National Innovation Demonstration Zone, Mianyang High-Tech Industrial Development Zone, and Deyang National High-tech Industrial Development Zone, and focusing on innovation resource aggregation areas such as Chengdu's university knowledge economy zone as key areas. "Vertical and horizontal integration" emphasizes collaborative innovation and the transfer

and transformation of achievements through military-civil fusion, opening horizontal channels for the bidirectional transfer and transformation of scientific and technological achievements between the military and civilians, and vertical channels for the local implementation of national scientific and technological achievements.

The specific goal is to promote the transfer and transformation of 1,000 military and civilian scientific and technological achievements by 2020 and incubate 1,000 science and technology-oriented small and micro enterprises with military-civil integration. It also aims to construct a demonstration base for the transfer and transformation of national major scientific and technological special project achievements in new drug creation, transform 50 achievements from scientific and technological special projects, and assemble more than 800 biopharmaceutical companies.

(5) International Cooperation

The institute, as an authoritative institution in the field of scientific and technological information in Sichuan Province, actively engages in multilevel cooperation with foreign governments and companies in the field of science and technology.

To cooperate with the construction and operation of the Chengdu University of Information Technology's International Research Institute for Robots and Smart Systems, the institute has signed an agreement with both the University and the EZLS Institute at the University of Siegen in Germany. It aims to build a high-level academic research center for the robot and smart device industry chain, as well as domestic and international research cooperation bases, by attracting the latest domestic and international research and development, thereby promoting the innovation and development of robots and intelligent systems.

(6) Challenges and Development Goals

In the future, centered around its users, with the help of network technology, the institute will explore what users are seeking, deliver the information they need, and achieve a comprehensive upgrade of services through its scientific and technological literature service platform. The scientific and technological literature service platform is rolling out services that deliver accurate information, integrate vast data resources, eliminate redundant information, and enable users to quickly and accurately access valid information. These achievements not only improve service quality through delivering accurate information but also satisfy users' needs for customized, precise services.

4.8.2 Beijing Institute of Science and Technology Intelligence ("北京市科学 技术情报研究所")

(1) Organizational Structure and Overview

The Beijing Institute of Science and Technology Intelligence is a public service organization centered on information research, affiliated with the Beijing Academy of Science and Technology. Its main responsibilities include providing information services to the government, public interest projects, information research and statistical analysis, database management services for scientific and technological information, and editing historical books.

The institute is a comprehensive and interdisciplinary information consulting organization without industry barriers. Established in 1973, it is a wholly government-funded business organization with eight business divisions. Its primary goal is to provide information consulting services to the government, enterprises, and public projects for the

economic construction of the capital.

It engages in research and development of information technology, collection, organization, and processing of various information materials, development of electronic government systems and computer information security products, website construction, decision-making consulting, technical consulting, social public surveys, corporate planning, market research, investigations into the novelty of scientific and technological contracts and projects, audio and video production, exhibition and display, printing services, and international exchange and trade.

The institute possesses strong technical capabilities and has a staff of 158. Among them is a team of high-quality talent, including dozens of doctors and master's graduates, contained within a logical organizational structure. It has won 8 national-level Science and Technology Progress Awards, 42 provincial and ministerial-level Science and Technology Progress Awards, 42 provincial Information Achievement Awards, receiving high recognition in China and playing a significant role in the information services of the Beijing region.

Its registered capital of the institute is 11.49 million yuan, with a total revenue of 81.87 million yuan in 2021, an increase of 2.55 million yuan (3.22%) from the previous year. Of this, income from fiscal expenditure was CNY74.28 million, accounting for about 91% of the total income. Business income was CNY7.53 million, equivalent to 9.19% of the total income. Other income was CNY61,700, equivalent to 0.08% of the total income. The total expenditure in 2021 was 75.8 million yuan, a decrease of 1,600 yuan from the previous year. Of this, basic expenditure was CNY60.52 million, accounting for 79.85% of the total expenditure, and project expenditure was 15.28 million yuan, accounting for 20.15% of the total expenditure.

(2) Cooperative Relationships

As a business organization under the Beijing Municipal government's science and technology departments, the institute actively addresses national and Beijing city policies and development plans in the field of science and technology, leveraging its two characteristics of being a science and technology think tank and disseminator of science from the perspective of research and analysis of scientific and technological information. It has conducted close cooperation and exchange with the government and enterprises based on the four research themes of new materials, biotechnology, information technology & smart manufacturing, and new energy & low-carbon technology promoted by the Beijing Municipal Government.

Based on the policies of the Beijing Municipal Government on these four research themes, it has signed strategic cooperation agreements with the National Environmental Protection Urban Noise and Vibration Control Engineering Technology Center, Beijing Key Laboratory of Cloud Computing Core Technology & Application, Beijing Key Laboratory of Organic Material Testing Technology & Quality Evaluation, Beijing Food Safety Analysis and Testing Engineering Research Center, etc., to cooperate in information sharing, scientific and technological innovation, and evaluation of achievements.

To fulfill its role as a think tank for the Beijing Municipal Government, the institute has signed strategic cooperation agreements for the dissemination of scientific and technological information and public education with the Beijing Planetarium, National Natural History Museum of China, and Beijing Milu (Père David's Deer) Ecological Experiment Center, acting as a pilot organization for building high-end think tanks in the capital.

In recent years, the institute has strengthened its cooperation with industry associations in the utilization of scientific and technological achievements, especially in the use of intellectual property rights. It actively performs exchanges with Beijing Tianjin Research Institute, Jinghe Research Institute, etc., on the utilization of intellectual
property rights, and established a platform for joint operation of scientific and technological achievements in Beijing, Tianjin, and Hebei, directly or indirectly promoting technology transfer and transformation of achievements, with the overall value exceeding 700 million yuan.

(3) Achievements and Areas of Expertise

The institute has strengths in scientific and technological policy simulation and policy decision support, using a wealth of domestic and international science and technology, economic statistics, and various advanced large-scale models to conduct scientific and technological policy simulation, forecasting, and analysis, supporting the Beijing Municipal Government's science and technology policy decisions.

In recent years, commissioned by the Beijing Academy of Science and Technology and the Beijing Science Committee, it has published studies such as Research on Energy Conservation and Reduction of Emissions in the Beijing Region ("北京地区节能减排研究") and "Research on the Contribution Rate of Scientific and Technological Progress in Beijing" ("北京市科技进步贡献率的测算研究").

(4) Success Stories

 Research on Mutual Development and the Achievement Integration Evaluation Technology of the Science and Technology Olympics

The Science and Technology Winter Olympics, a special project led by the Beijing Academy of Science and Technology under the national key research and development plan, consists of six themes, of which the Beijing Institute of Science and Technology Intelligence was responsible for two: research on the theory and practice of mutual development between the Olympics and science and technology, and construction of an evaluation and information management analysis system for science and technology Olympics achievements.

These themes were approved and accepted by the Beijing Winter Olympics Organizing Committee in May 2021. The report the institute produced referenced the 2008 Science and Technology Olympics, emphasizing the introduction of China's scientific and technological innovation to the world through the Olympics and gaining worldwide recognition and praise for China.

(2) Research on the Analysis and Forecast of China's Science and Technology Investment Policy from 2011 to 2020 China's fiscal allocation in the field of science and technology increased from 5.289 billion yuan in 1978 to 322.49 billion yuan in 2009, an average annual increase of more than 19%, providing strong financial support for the development of China's science and technology business and continuing the investment of fiscal funds in science and technology beyond the traditional planned economy system. However, problems such as unclear investment targets, insufficient total investment, and an irrational structure have limited the further development of fiscal fund investment in China's science and technology, hindered the promotion of structural transformations in China's economy, and weakened the power of China's sustainable economic and social development.

The institute's report, focusing on fiscal fund investment in China's science and technology, explored problems in the allocation of these funds to scientific and technological resources, based on an international comparison of fiscal fund investment in science and technology, and summarized the experience of advanced countries surrounding government investment in science and technology. Finally, it made policy suggestions for improving fiscal fund investment in science and technology, proposing two investment models of government planning and market financing, suggesting that the government should prioritize investment in basic research and public scientific and technological fields related to public assets.

(5) International Cooperation

The Beijing Science and Technology Economic Information Federation Center and the Beijing Society for Science and Technology Information serve as the institute's external exchange windows, maintaining good and close relationships with central ministries and academies in Beijing, scientific research and information institutions of academies and universities, and foreign information institutions, conducting extensive exchanges in personnel, technology, information, and products with regions and countries such as the United States, Russia, Japan, Korea, and Central Asia.

In recent years, in response to changes in the international situation, it has further expanded its international partners, using countries like Russia and Central and Eastern Europe as breakthrough points. In June 2017, it signed a memorandum of technical cooperation with Germany's Steinbeis Advanced Risk Technologies Group, agreeing to cooperate at the project level on new methods and tools for risk management in science and technology innovation, technology transfer, education, research and development and consulting services, and new biofuels and coating technologies.

In April 2018, it signed a memorandum of understanding on scientific and technological cooperation with the Czech Academy of Sciences (CAS), agreeing to further cooperate in fields such as the construction of scientific and technological information databases and the application of artificial intelligence in scientific and technological information.

Additionally, the progress of the national Belt and Road cooperation project has led the institute to strengthen its cooperation with Asian countries. In 2019, an agreement was signed with the Korea Institute of Industrial Technology for regular technical exchanges and cooperation in fields such as robot research and development, applying innovations in the construction of smart cities, smart transportation, fuel cells, and the construction of waste-free cities.

(6) Challenges and Development Goals

As the scientific and technological information industry becomes nationally important, the environment surrounding the scientific and technological information service industry is also changing significantly. Various information institutions have rapidly developed in response to market needs, and state-owned, privately-owned, collective, and foreign-funded information service institutions are now competing in the market together. A domestic scientific and technological information consulting industry has rapidly emerged with the development of the market economy. In particular, private information institutions have gained comparative advantages amongst intense competition by adopting flexible mechanisms.

To compete, it is first necessary to establish a new concept of information. Under market economy conditions, traditional scientific and technological literature novelty investigation check and search services fall far short of meeting the real needs of the institute's varied users and service recipients. Traditional scientific and technological information has been replaced by a higher level of "new information", including policies and regulations, technological foresight, industry tracking, market research, competitive intelligence, and patent services. Any information organization that ignores the reality of social development, fails to deepen the content of its research services in time, and does not adjust the knowledge structure of its personnel will undoubtedly be abandoned by society. With the acceleration of the digitization and networking of scientific and technological information resources, it is necessary to update the model of scientific and technological information services.

5 Challenges and Future Prospects for STIAs

This section was written by Professor Duan Xue from Beijing University of Chemical Technology. Professor Duan Xue specializes in inorganic supramolecular chemistry, serves as the Vice President of the China Technology Market Association and has extensive knowledge of Science and Technology Intermediary Agents. He is also listed as an academician of the Chinese Academy of Sciences, considered the highest honor in the field of science and technology in China. Academicians have the right to propose and recommend policies on important national science and technology issues. The position of an academician is for life⁸¹. He serves as a member of the Academic Degrees Committee of the State Council in the Department of Chemical Engineering, a member of the Department of Chemistry at the National Natural Science Foundation, a member of the Department of Chemical Engineering at the Ministry of Education's Science and Technology Committee, and a member of the Expert Advisory Committee for National Basic Education Curriculum Materials.

5.1 Expected Contributions of STIAs to China's Scientific and Technological Progress and Innovation

(1) Intermediary Agencies: Breaking Down Structural Defects

1. From "Matchmakers" to an Intermediary System

Science and Technology Intermediary Agents play the role of a lubricant in the rational allocation of scientific and technological resources and the integration of various expertise. They facilitate communication and bridging between various stakeholders (researchers who invent scientific and technological achievements, entrepreneurs, investors, etc.) and institutions in the science and technology innovation ecosystem, promote the transformation of scientific knowledge information into technology on the science and technology innovation platforms, and advance the progress of a society based on science and technology.

STIAs are one of the carriers of science and technology innovation platforms and an important component of China's science and technology innovation system. In recent years, as China's economy enters a new stage of development, it is facing various risks and challenges that also impact society at large, such as instabilities in the international industrial chain, geopolitical influences, and domestic pandemics. To take the lead in development, it is crucial to rely on the intrinsic power of science and technology innovation and fully leverage the function and role of STIA's in the country's science and technology innovation. Initially, China's STIA's were naturally dispersed as technical brokers. They then evolved into singularized matchmakers of science and technology and are now transitioning into a more functional and improved science and technology intermediary service system. Their value and significance are now becoming increasingly evident.

⁸¹ "中国科学院院士章程"(https://casad.cas.cn/xbjs2022/gzzd/yszc/)

One structural defect of China's science and technology innovation network lies in the lack of connections between research and development institutions, universities, and enterprises. The main cause of the disconnection between upstream and downstream in the science and technology innovation system is the mismatch between scientific and technological achievements and the problems faced by enterprises. STIAs, acting as aggregators of multifaceted information, require strong professional capabilities to assist in organizing and identifying "pain points" for enterprises, feeding this information back to research and development institutions, and guiding their research towards solving these pain points.

2. Optimizing the Allocation of Resources Between Regions

STIAs comprehensively and deeply understand regional industrial situations and policies, supporting research and development institutions to focus on common issues and gaps in the regional industry chain, achieving breakthroughs. By pooling and organizing information, they can identify key technological problems of region-specific industries, find common obstacles in the industry, and promote the industrialization process of scientific and technological achievements. STIAs facilitate communication and bridging between different innovation stakeholders, constructing the science and technology innovation system and improving the efficiency of disseminating technological innovations.

The imbalance between development in Eastern and Western China is well known—and reflected in the levels of economic and scientific and technological development—with scientific and technological resources skewed towards the East. The presence of STIAs can break down regional constraints, enable collaboration with players from other regions and the incorporation of their scientific and technological achievements, optimize regional scientific and technological resources, and achieve optimal allocation of resources between regions. Innovation carriers within a region often face the problem of sparse relational networks. Connecting these carriers can effectively mitigate such issues, expanding the routes and objectives of scientific and technological information, optimizing the allocation of regional resources.

(2) Contributions to Scientific and Technological Progress and Innovation

1. Matching Research Outcomes with Societal Needs

STIAs and enterprises influence each other. Currently, enterprises in China are not the main producers of research and development, and at the nodes of the technological innovation process and in some regions, despite the willingness, there is a lack of capability, meaning the services provided by STIAs are capable of solving a series of issues. While considering the situation of individual enterprises, STIAs can align technological resources with internal resources, reduce research costs and optimize the allocation of scientific and technological resources. They can also provide technical support to enterprises and accelerate their technological innovation. By hosting job fairs, inviting experts for regular training and special lectures for employees, and recruiting and cultivating a variety of talent according to the scientific and technological personnel needs of each enterprise, STIAs can increase the overall pool of available talent. 2. Advancing the Integration of Industry, Academia, and Research

Universities and research and development institutions are not only key carriers in the development of China's science and technology but also crucial bases and foundations in the construction of science and technology innovation platforms.

They play two main roles in the academia and research part of industry, academia, and research systems. Universities and research institutions must change the current situation where they prioritize research over services in building science and technology innovation platforms. They should no longer separate research and services, but closely integrate technological services with research. From this, they need to find innovative breakthroughs and not confine research to just the laboratory stage. At the same time, they must be able to convert research results into advanced productive forces.

STIAs play a crucial role in this area. By utilizing their information resources, they can guide universities and research institutions to conduct research activities in line with market needs, adjust research directions in a timely manner, and align research outcomes with societal needs. At the same time, they can attract investment from enterprises into the research activities of universities and research institutions, promoting the transformation of scientific and technological achievements.

Due to their expertise and knowledge-intensive nature, STIAs provide specialized services such as consulting, information, and platforms related to research and development to universities and research institutions. They facilitate the transformation of research outputs such as academic papers, specialized works, and research reports from these institutions. Furthermore, they convert the advantages of universities and research institutions in terms of knowledge resources, human resources, and research and development resources into competitive advantages in the field of science and technology. Furthermore, STIAs can communicate the research and development needs of enterprises to universities and research institutions in a timely manner, effectively connecting these entities together. This will mean research by universities and research institutions is market and industry-oriented, advancing the true integration of industry, academia, and research.

The government plays an organizational and leading role in the activities of enterprises, universities, research institutions, and STIAs, in both the national and regional innovation systems. Using STIAs, the government can fully enhance enthusiasm towards and efficiency of innovation in industry-academia-research collaboration.

By fully exerting their market regulation function STIAs can achieve the optimal allocation of productive factors in science and technology. They implement government policies and plans at the micro-level, realizing a model that combines market and management, optimizing the allocation of scientific and technological resources in the innovation system.

Additionally, some STIAs can standardize the behavior of market players, supervising and regulating the technology market. For instance, Productivity Promotion Centers perform tasks such as qualification examinations and certifications, along with providing policy recommendations, supervising and guiding various players within the science and technology innovation system on behalf of the government.

A series of commercial activities such as technology transfer, technology contracting, technology consulting, and holding shares in technology are conducted in the technology market. Corresponding technology intermediary activities supervise both parties in technology transactions. They provide specialized services at any part of the process, standardize market behaviors, offer a fair competition arena, prevent misconduct in technology transactions, and can mediate disputes in the technology market.

5.2 Challenges and Future Prospects for STIAs

The challenges faced by China's Science and Technology Intermediary Agents are outlined below.

(1) Policies and regulations related to science and technology intermediation are not sufficiently developed

Currently, regulations concerning science and technology intermediation are insufficiently developed, resulting in ineffective management of STIAs. At the same time, the positioning of science and technology intermediation within China's economic system is not clear, and its legal and economic positioning and operating mechanisms are questionable and not generally recognized, resulting in the science and technology intermediation market not being standardized and not achieving rapid development.

In China, determinations regarding policy establishment are based on laws created by the National People's Congress (NPC), administrative regulations and policies of the State Council and its departments, and local ordinances. The lack of developed policies and regulations for science and technology intermediation means that there are no NPC-level laws, few local ordinances, and a lack of legal interpretations for dispute resolution in the intermediary sector. In terms of science and technology intermediation, although market economy efficiency is promoted, in reality, organizations from the planned economy era are the main players, and actual business rules depend on planning and administrative orders, causing significant distortions. Policies and regulations to correct these distortions have not yet been developed.

(2) The low level of specialization in science and technology intermediation services, and the shortage of professional personnel

For technology intermediation to function as a bridge and lubricant among various players in the innovation platforms, a knowledge of technology and law is not enough; highly specialized, practitioners who have a sense of professionalism and are proficient in management are required. Examining the current professional qualifications of science and technology intermediary personnel indicates a major lack of capabilities in this area. Marketing strategies and tools cannot adapt to the current development of the market economy and have limited ability to develop the science and technology market. Additionally, the content of science and technology intermediation is relatively basic and incapable of providing timely, effective, and comprehensive services.

(3) Insufficient recognition of the role of science and technology intermediation among science and technology innovation platform players

Due to traditional values, there is a lack of correct understanding of science and technology intermediation among all sectors of society, and because of not being accustomed to relying on the market for resource allocation, paid science and technology intermediation services are not greeted warmly. Universities and research and development institutions are accustomed to the traditional method of applying for research projects, supervising and managing them, and then undergoing inspection and reporting results. Thus, they do not pay sufficient attention to the dissemination and transformation of scientific and technological achievements, exacerbating the situation surrounding a lack of proper science and technology intermediation.

Moreover, enterprises have certain misunderstandings about science and technology intermediation, not fully recognizing its role and lacking the very concept of consulting with professional intermediary agencies. All these factors are affecting the development of science and technology intermediation.

(4) Future Prospects

With the easing of measures against COVID-19, the long-term development of the economy is expected to shift from stable to positive. The Law on Promoting the Conversion of Scientific and Technological Achievements, provisions regarding this law, and the Action Plan for Promoting the Transfer and Conversion of Scientific and Technological Achievements, along with legal provisions and regulations supporting the science and technology intermediation service industry indicate institutional guarantees and the direction of industry development. The following developments are expected in the future:

1. A customized one-stop sub-service model

In major cities like Beijing, more advanced science and technology Intermediary Agents will meet market needs, forming multipoint interfaces in terms of technology, capital, application, and market, and promoting the transformation and transfer of scientific and technological achievements. Based on the information sharing service platform for technological achievements, a customized supply of technology achievements and a one-stop service model will be realized.

2. The emergence of Science and Technology Intermediary Agents specializing in the integration of green and circular economy

It is likely that carbon-neutral and green Science and Technology Intermediary Agents will steadily emerge. Many STIAs will support companies aiming for sustainable development by promoting innovation amongst green industries, introducing and strengthening specialized auxiliary service capabilities centered on green industry, green finance, green offices, and developing and nurturing specialized services for the circular economy.

3. Birth of a government-led integrated technology intermediation service platform

The China Technology Market Association has held several discussions with experts from the Ministry of Science and Technology Torch Center and the science and technology service industry. Specifically, discussions were held on the theme of building a comprehensive, integrated public service network for scientific and technological innovation that covers the entire chain from scientific and technological achievements, industrial layout, science and technology financing to market applications, using the Zhongguancun Science and Technology Park in Beijing as a platform.

In the future, with the easing of measures related to COVID-19 and the return to normalcy in society and the economy, a government-led integrated platform for technology intermediation services, connecting STIAs in the eastern, central, and western regions and spreading across many regions, will be steadily implemented, with local science and technology departments following up on related activities.

6 Comments on the Survey Results by Experts in Japan

The survey results were reviewed by the following experts:		
Name (in Japanese alphabetical order, honorifics omitted)	Affiliation	
Ryoji Haraguchi	Director of the Department of Intellectual Property Management, Japan Science and Technology Agency	
Nobuhiro Horii	Associate Professor, Graduate School of Economics, Kyushu University	
Shunji Matsuoka	Professor, Graduate School of Asia-Pacific Studies, Waseda University	
Tomoo Marukawa	Professor, Institute of Social Science, The University of Tokyo	

Ryoji Haraguchi (Japan Science and Technology Agency)

This research report introduces the Science and Technology Intermediary Agents established in 2003 as pillars of the national innovation system in China. It covers their progress, detailed activities, and achievements, and summarizes the current challenges facing these organizations.

In their approximately 20-year history, STIAs have continuously improved mechanisms to facilitate the transfer of university and research institution outcomes to spur venture creation and enhance the development capabilities of small and medium-sized enterprises without their own R&D capacities. This report highlights their ongoing improvements and reflects a strong determination to leverage science and technology for China's development.

It details how STIAs are driving industrial development by linking government, academia, research, industry, and finance, assigning individual roles to eight organizations to advance various initiatives. Notably, it summarizes the following initiatives:

(1) Incubators

Incubators provide a multidimensional service system of physical space + specialized services with participation from end users, establishing a collaborative environment involving government, industry, academia, research, and users, including financial institutions. They are leading the development of comprehensive platforms for personnel training, venture creation, corporate restructuring, investment, financing, and project attraction.

(2) Productivity Promotion Centers

These centers aim to effectively promote industrial development by acting as intermediaries, transferring scientific and technological (academic and research) achievements to nurture emerging businesses and assist enterprises. Initiatives include training individuals with the skills required by businesses within educational settings, constructing laboratories jointly with academia and industry, enhancing the ability to strategically develop corporate intellectual property, and also promoting the establishment of high-tech incubation hubs at universities. This encourages a comprehensive and multidimensional collaboration between academia and industry, advancing the creation of

mechanisms for ongoing research and development.

(3) Technology Achievement Transformation Centers

Energize the transformation of scientific and technological achievements through academia-industry collaboration by incorporating policies that assess and incorporate the policy needs of both sectors (establishing information dissemination networks and platforms based on academia-industry needs, pre-evaluation and screening mechanisms based on industry needs, promoting university science parks based on academic needs, and constructing a healthy intermediary service system based on industry needs) and strategically advancing them.

(4) Technology Property Right Exchange Organizations

Besides promoting intellectual property transactions, these organizations supervise transactions and mediate disputes over contract breaches to ensure transaction credibility, thereby contributing to the recognition of intellectual property rights as core assets of science and technology companies in the financial market. They also play a role in expanding the technology transfer network through efforts to ensure reliable transactions and expand transaction volumes.

(5) Science and Technology Financial Service Organizations

From the initial stages of receiving government guidance funding through to transforming scientific and technological achievements, these organizations work to create an environment conducive to private lending (developing a cultivation plan with a "one company, one strategy" approach, introducing third-party rating agencies to provide comprehensive quantitative scores and detailed reports, etc.), including models incorporating intellectual property as collateral to increase private investment.

(6) Patent Agencies

Focusing on providing comprehensive services related to patents (patent application, invalidation of patent rights, IP strategy planning, patent transaction practices, etc.), led by a team of experts including patent attorneys, aimed at companies with weak IP management capabilities. They also aim to enhance IP literacy among researchers, universities, and small and medium-sized enterprises with low patent awareness, working to increase the value of intellectual property rights through academia-industry-research collaboration.

(7) Science and Technology Evaluation Organizations

Conduct pre-evaluation, ongoing evaluation, post-evaluation, and follow-up evaluation of scientific and technological activities, including evaluating projects and science and technology personnel. These evaluations are utilized in corporate decision-making, bank financing, science insurance, and comprehensive evaluation of intellectual property rights, playing an important role in the collaboration between government, industry, academia, research, and finance. (8) Science and Technology Information Service Organizations

By providing information to the main bodies of science and technology innovation (companies, universities, research and development institutions, and researchers), these organizations contribute to the construction of a network platform for cooperation among industry, academia, and research. Through information analysis, they offer insights into technology and market prospects and objective evaluations of scientific and technological achievements. Furthermore, their consulting divisions actively support industry, academia, and research by contributing to the formulation and implementation of policies, as well as creating roadmaps tailored to the development of startup companies.

Including the activities mentioned above, the report mentions the eight organizations have been vigorously engaging in a variety of other efforts. It's worth noting that these efforts are guided by a philosophy aimed at maximizing the impact of each. (1) All organizations focus on providing services and concurrently enhancing the capabilities and development of the people involved, aiming for the realization of their visions.

(2) Reliability in the activities (primarily evaluation initiatives) of the eight organizations is emphasized to promote an environment conducive to new business entries and lending from financial institutions.

(3) To ensure continuity in the eight organizations' services (from the transformation of scientific and technological achievements to the creation of industries, required funding during that period, through to end contracts), deliberate functional overlaps and usage relationships among organizations have been incorporated amongst them.

Chapters 3 and 4 of the report highlight their specific achievements, and Chapters 4 and 5 offer a self-analysis of current challenges, suggesting that further improvements in these initiatives will lead to the further development of the system.

In conclusion, from my perspective, seems quite challenging for entrepreneurs and small to medium-sized enterprises to fully understand and utilize these constantly evolving organizations. Therefore, I believe there is a need for an entity that is thoroughly familiar with the functions and experts of the eight organizations to provide one-stop access to the appropriate contacts within each organization at the right time and in the right order, and to support high-quality communication between both parties. Having such an entity that engages with users from start to finish could prevent midpoint failures and reveal missing services.

While this report does not clarify whether such a cross-organizational, one-stop mechanism, or something similar is already in place, it is an area that needs consideration.

Nobuhiro Horii (Kyushu University)

In the field of semiconductors, China's technological level lags not only behind the United States and Taiwan but also significantly behind that of Japan and South Korea. However, in recent years, China has successfully reached the global forefront in final products such as telecommunications, electronic payments, AI, drones, robots, etc. How China caught up so rapidly is of great interest, especially considering that, despite being at the forefront in various fields at one time, Japan is now facing an undeniable decline. This makes the success factors behind China's progress all the more critical for our potential recovery.

There is no doubt that the foundations for science and technology in China are improving. For instance, in terms of the number of scientific and technical papers and citations, China has overtaken the United States to become the world leader. However, what is more noteworthy is its high rate and speed of technology industrialization. Despite having high-level technologies, there are many cases where Japan has failed to commercialize these technologies effectively, leading to missed opportunities. The functionality behind the process from research and development to industrialization fin China represents a specific issue that captures one aspect of China's success in rapidly catching up.

Given this context, the subject of this report on the structure and functions of China's STIAs addresses a relevant and significant issue. This report analyzes eight types of STIAs regarding their objectives, the background of their establishment (underlying policies), their intended functions, and their actual activities. I specialize in industry research, particularly in China's energy and environmental sectors. However, my laboratory conducts research across various industries, including those with high levels of technological intensity. Therefore, I continuously monitor trends in China's research and development system. However, I was not aware of more than half of the eight STIAs mentioned in this report. Thus, this report truly depicts the commercialization process of technology in China from a broad perspective.

This report first explains in Chapter 1 the context in which the role of STIAs has increased due to reforms involving the reduction of government involvement in the policy implementation phase and the government's increase in making decisions through the market. Chapter 2 examines the functions and roles of eight types of intermediary agencies from an institutional perspective. Chapter 3 then analyzes the actual activities of STIAs, presenting statistical data. Chapter 4 serves as a case study, providing two examples for each type of STIA, including descriptions of success stories, and enabling a concrete understanding of their functions. The challenges faced by each are also candidly discussed. Chapter 5 is akin to a summary of the overall report, discussing evaluations of the current state of STIAs, challenges, and future prospects. Additionally, the references include summaries of policies related to STIAs by the central and local governments.

Based on the content of this report, China's process of industrializing science and technology can be understood as follows: The statistical analysis presented in Chapter 3 suggests that STIAs play a certain role, frankly, more than expected, in the industrialization of science and technology in China. For example, the total income of productivity promotion centers is about 2.3 billion yuan (approximately 45 billion yen), which is considerably large. However, the case studies in Chapter 4 indicate that a significant portion of the income comes from the public sector, such as the government and state-owned enterprises, with less from private companies. The report points out that one reason for this is that most STIAs face challenges due to their lack of highly specialized human resources. Many incubators are "school-run enterprises" established with investments from universities, leading to a bias towards universities and research institutions, which are the main bodies of technology development, and insufficient coordination with the industrial side. The report also points out the failure to produce product development and sales methods that consider market needs.

To summarize the overall situation: realizing the government's goal of becoming a strong science and technology nation requires government strategy enabling a system that minimizes government involvement and leaves decisions to the market. However, it is hoped STIAs will fulfill functions that cannot be met by leaving it to the market alone, such as through guidance functions that reflect the direction of industrial development and preventing mismatches in supply and demand due to information asymmetry (thus reducing the necessary search costs). However, despite these hopes, the current functions of intermediary agencies have limitations and do not always produce sufficient effects. However, as described in the report, much of the government support for STIAs began in the 2010s, which is still only about a decade ago, so it may be natural for these limitations to still exist. In this sense, this report's value can be found in its focus on STIAs at a relatively early stage and its attempt to assess their actual conditions.

Acknowledging the value of this report, I would like to make the following suggestions for subsequent investigations, including those for the next fiscal year and beyond. If the summary I produced above is correct, there might be factors other than the functions of STIAs that have spurred on the industrialization of science and technology in China over the past decade. This area warrants investigation. Although this might have already been investigated by JST, one proposal would be to conduct research that typifies this process by accumulating case studies of individual technologies, examining which entities were involved and how they produced industrialization.

As an addition to this report, it would be beneficial to have a chapter that provides an overview from a comparative perspective on the functions and roles of institutions similar to China's STIAs, at least in Japan, and preferably in the United States (and possibly Europe if feasible). Also, having a chapter providing a numerical assessment of the overall picture of the industrialization of science and technology in China would provide an understanding of the relative

positions of the roles played by STIAs. Additionally, the current structure of the report, which arranges descriptions of eight types of STIAs by theme, might be more understandable to readers (and prevent duplications of explanations) if it were organized into chapters connected from upstream to downstream in the process of science and technology development, summarizing the STIAs involved at each stage.

Shunji Matsuoka (Waseda University)

After reading through this report, I would like to discuss my thoughts and feelings on its content, focusing on the formation of "spaces" in the innovation ecosystem. I also want to consider the relationship between technological innovation and social innovation within these spaces.

This excellent report systematically analyzes China's science and technology intermediary associations, which are science and technology service industries that play a role in mediating and facilitating the linkage and collaboration between knowledge production in the science and technology sector and production activities in the socio-economic sector. It also covers their historical development, definition and classification.

Of course, as Professor Duan Xue of Beijing University of Chemical Technology (an academician of the Chinese Academy of Sciences and one of the report's authors) says of the current situation in China, "There is no consensus on the definition of the science and technology service industry and the classification of STIAs." Therefore, the eight classifications of STIAs adopted in this report (incubators, productivity promotion centers, technology achievement transformation centers, technology property right exchange organizations, science and technology financial service organizations, patent agencies, science and technology evaluation organizations, and science and technology information service organizations) are provisional, and it is expected that as developments proceed, their organization and integration will progress, along with further specialization and differentiation.

However, this provisional nature is considered natural when targeting a dynamic society like China and dealing with large variations in innovation and does not detract from the significance or importance of this report. Rather, the report should be seen as providing valuable material for understanding China's innovation system, which is emblematic of the 21st century's era of VUCA (Volatility, Uncertainty, Complexity, Ambiguity).

A key concept when discussing the contemporary national innovation system is the innovation ecosystem. Generally, an innovation ecosystem is understood as "a system where diverse organizations across industry, government, and academia continue to collaborate and compete, inducing innovation. This converts scientific knowledge, including basic research, into new products, services, and new markets, increasing socio-economic value and forming a better society" (JST, 2021, p.1). Moreover, such innovation ecosystems are defined as "mechanisms where information, talent, funds, and systems freely and openly interact and connect" (JST, 2021, p.1).

The STIAs targeted in this report are organizations responsible for forming the physical spaces of the innovation ecosystem. According to management scholar Hiroyuki Itami, the formation of spaces requires the following four points (Itami, 2005; Matsuoka, 2022):

(1) Ownership of the Space

The starting point of an innovation ecosystem's space is the presence of a host with a strong sense of mission and the capability to generate innovation through collaboration with various stakeholders. The host is required to possess the necessary resources (knowledge, information, social capital such as human relationships, and resources such as people, goods, and money) for forming and managing the space. The owner of the space is the host, who has the

authority to select members, set the agenda, and establish rules.

(2) Membership of the Space

The issue of membership, how participants in the innovation ecosystem's space are selected, is a crucial point that determines the environment and foundation of the space. In the initial stage of the space, there is a significant disparity in knowledge and information about science, technology, innovation, and the market environment among participants from government, industry, bureaucracy, and academia. Such disparities in the amount of knowledge and information can be a significant obstacle to creating a free and equal space. Regardless of the amount of knowledge and information, an environment and foundation that enable free and equal collaboration are necessary. For this, participants in the space are required to have sincerity and respect for each other, as well as the ability to empathize with others. Empathy supports collaboration, nurtures the power of collaboration, and enables discoveries through collaboration. At the same time, all participants are required to treat the space of collaboration as a space for learning. To make collaboration in the space effective, it is necessary to utilize the micro-macro loop mentioned later.

(3) Collaboration and Partnership in the Space

The basic factors of the innovation ecosystem's space are (1) setting an agenda, (2) rules for collaboration, (3) the importance of face-to-face interactions for information sharing, and (4) cultivating a collaborative consciousness based on empathy.

(4) The Importance of the Micro-Macro Loop

The functioning of the space in the innovation ecosystem advances informational interactions within it, stimulates individual learning among participants, and generates accumulation of information by individuals. This accumulation further promotes informational interactions in the "pace, enhancing a common understanding of topics and the integration of efforts among participants, forming a mechanism that expands reproduction (micro-macro loop). Whether the innovation ecosystem's space can be nurtured and discoveries and knowledge creation through collaboration can be made possible depends on how well the micro-macro loop functions.

Based on this theory of spaces by Itami, let's examine China's Science and Technology Intermediary Agents as organizations responsible for forming the spaces of the innovation ecosystem.

First, in terms of ownership as a host with a high sense of mission and capability to generate innovation, STIAs in economically advanced coastal provinces, such as the Shandong Productivity Promotion Center introduced in Chapter 4 of this report, and national-level Science and Technology Intermediary Agents such as the China Technology Exchange Information Service Platform, are considered to have a high level of ownership. However, such organizations are a minority among the 1,186 productivity promotion centers and 5,843 incubators nationwide, and it's likely many STIAs have not reached a sufficient level of ownership.

It is easy to imagine that those that which not reached a sufficient level of ownership lack the ability to select members, form strong partnerships, and create micro-macro loops.

The issues faced by China's Science and Technology Intermediary Agents as organizations responsible for forming the spaces of the innovation ecosystem are fundamentally related to their personnel training (clearly defining an image of science and technology intermediary personnel) and their legal and institutional positioning (clearly defining the social activity space).

STIAs' personnel training and legal and institutional positioning can be said to be the challenges of social innovation, which involves the creators of technological innovation and the creation of new social organizations

and social systems. In this sense, China can be seen as being in the process of challenging itself to co-evolving technological innovation and social innovation (Matsuoka, 2018).

The future development of China's STIAs will be of great interest. The current situation in Japanese society, where the co-evolution mechanism of technological innovation and social innovation is not functioning well, indicates Japan has much to learn from the development of China's Science and Technology Intermediary Agents, and continued attention to this area is necessary.

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Tomoo Marukawa (University of Tokyo)

The main carriers of science are universities and public research institutions, but since it is inappropriate for these carriers to directly undertake profit-making businesses, it is necessary to mediate their research outcomes towards profit-oriented private companies. However, the newer the results are, the less likely they are to become large-scale industries from the start and must begin as small-scale ventures. It is also difficult for small businesses to conduct all the necessary prototyping, testing, measurement, and inspection in-house, requiring the assistance of other companies or institutions.

Science and Technology Intermediary Agents were created for this purpose—as mediators to advance the industrialization of science and technology. However, these organizations are not the only mediators. Various companies not mentioned in this report also act as intermediaries. For example, during my visit to an automobile development center in Shanghai, not only did they develop cars for their parent company, but they also undertook a large amount of testing work from other automakers, and it was common to see small and medium-sized enterprises outsourcing prototyping to other companies.

Intermediaries are necessary for the industrialization of science and technology in situations where technological innovation is active and numerous startups are being created. Even if technological innovation is active, if the carriers of this were only large corporations with many internal resources, there would be little need for intermediary organizations. The situation in China is closer to the former situation, and Japan is rather closer to the latter, so it is understandable that more intermediary organizations have emerged in China than in Japan.

However, this report does not start by observing who the intermediaries in the industrialization of science and technology achievements in China are. Instead, from the beginning it limits the topic to specific types of organizations. Simply put, the subject of analysis in this report is limited in scope to the Ministry of Science and Technology. An overall picture of how the industrialization of scientific and technological achievements is conducted in China is not easily grasped from this report alone.

The organizations covered in this report, listed in order of importance and contribution, are incubators, productivity promotion centers, technology achievement transformation centers, technology property right exchange organizations, science and technology financial service organizations, patent agencies, science and technology evaluation organizations, and science and technology information service organizations.

Most of the organizations listed here are ones that do not take risks for specific projects. For example, patent agencies are businesses that earn fees by supporting patent applications at the request of companies, and their revenue is not affected by whether the company's business using the obtained patents succeeds or fails. Similarly, science and technology evaluation organizations do not bear risks for the commercialization of specific scientific and technological achievements, even if they evaluate them highly. However, it is questionable whether organizations that merely mediate or evaluate without taking risks can truly be connoisseurs of the economic value of scientific and technological achievements. Do these organizations have an incentive to discern economically successful science and technology?

Most notably, among the organizations covered in this report, incubators have recently started providing investments, as mentioned in several places in the report. That is, incubators, which originally just operated tenant buildings for startups, while adding startup guidance and shared facilities without directly being involved in the businesses of the resident companies, have recently started investing in the capital of these companies.

However, the report does not cover venture capital, which plays the most crucial role in nurturing startups. In China, domestic and foreign venture capitals play an important intermediary role in scaling up scientific and technological achievements into significant businesses. The number of unicorns (unlisted companies valued at over 1 billion dollars) being the second highest in the world after the United States symbolizes their performance. Venture capital aims to grow startups and eventually sell their shares for a profit. It thus has an incentive to discern economically successful scientific and technological achievements. Furthermore, the STAR market, where companies scaled up to a certain extent by venture capital go public to raise further funding for expansion, is also an institution to assist in the commercialization of scientific and technological achievements.

This report does not touch upon venture capital or the STAR market. Science and Technology Financial Service Organizations seem to include something like venture capital, but they are given their name because they are managing government funds, such as the National Guiding Fund for the Conversion of Scientific and Technological Achievements, so this is generally not venture capital.

Among the STIAs covered in this report, many are engaged in the evaluation of scientific and technological achievements. For example, the Qingdao Technological Achievements Standardization Evaluation Service Platform and the Henan Zhongchuang Technology Evaluation Institute exemplified as "Science and Technology Evaluation Organizations" specialize in evaluation, and the Jiangsu Productivity Promotion Center also implements an enterprise innovation score system evaluation. However, since scientific and technological achievements will be mercilessly evaluated by the market once commercialized, the necessity of evaluations by intermediary organizations outside the market is questionable. Looking at the purposes of the evaluations conducted by the three mentioned organizations, they seem to be conducted when awarding science and technology prizes or deciding on government subsidies.

However, it is questionable whether such evaluation activities can promote the industrialization of scientific and technological achievements. Since people's needs are diverse, even products not favored by the masses can become economically independent if they capture a niche market. Regardless of being highly evaluated by experts, they might

lack a place in the market, or conversely, they might find a place even if these experts evaluate that they don't. The Ministry of Science and Technology in China awards various prizes for scientific and technological achievements, but the ability to fairly award such prizes and the ability to discern outcomes that will generate revenue through industrialization are not the same.

If promoting the industrialization of scientific and technological achievements is a policy objective, then incubators, productivity promotion centers, technology achievement transformation centers, and technology property right exchange organizations undoubtedly contribute to that policy objective to some extent. However, in reality, venture capital makes the largest contribution. It is also unclear whether science and technology evaluation organizations contribute to industrialization.

"Letting the market play a decisive role" is the current general policy of the Chinese government. In the industrialization of scientific and technological achievements, where market economy factors such as venture capital already play a significant role, the government (Ministry of Science and Technology system) is also heavily involved in the operation of various centers. This report is written only from the perspective of enhancing such involvement, but it may be necessary to reconsider these policies from a suspicion that the government's involvement might be excessive.

[Reference Materials] Policy Positioning and Support for STIAs

1. Central Government Policies

In August 1992, the State Council of China issued the "Opinions on Accelerating the Development of Science and Technology Information, Science and Technology Consulting, and Technical Service Industries," outlining the positioning, role, and principles of government support for the science and technology service industry and supporting the establishment of science and technology service businesses by research institutions and universities. However, the science and technology issued the "Opinions on the Active Development of Science and Technology Intermediary Agents," which defined the framework for Science and Technology Intermediary Agents, which can be considered the carriers of the science and technology service industry. The following year, 2003, was designated as the year of establishment of Science and Technology Intermediary Agents.

Since then, up to the end of September 2022, a total of 20 policies related to Science and Technology Intermediary Agents have been issued at the levels of the National People's Congress (NPC), the Standing Committee of the NPC, the State Council, and the Ministry of Science and Technology. This includes laws such as the Law on Promoting the Transformation of Scientific and Technological Achievements (October 2015) and the Law on Progress of Science and Technology (January 2022). Both indicate the direction for the transfer and transformation of scientific and technological achievements and support the establishment of an institutional mechanism for science and technology innovation.

The Ministry of Science and Technology, the supervisory department of Science and Technology Intermediary Agents, has issued a total of 8 policies since 2002, including the "Opinions on the Active Development of Science and Technology Intermediary Agents," but following the State Council's institutional reform in 2023, the policy on Science and Technology Intermediary Agents was transferred to the Ministry of Industry and Information Technology. The kinds of new policies that will be introduced due to this change in supervision is of interest.



Primary Policy Developments Concerning Science and Technology Intermediary Agents

Source: Created by Tepia Corporation Japan

Regulation Name (Issuing Department and Implementation Date)	"Opinions on Accelerating the Development of Science an and Technology Consulting, and Technical Service Industries 技术服务业的意见") (State Council, August 22, 1992)	d Technology Information, Science s" ("加速发展科技信息、科技咨询和
Main Content		Importance and Impact

1. Various service industries related to the advancement of science and technology (hereinafter referred to as "science and technology service industries") should be intensively cultivated to become new important service industries and should contribute to the promotion of the tertiary industry and the development of the national economy as a whole.

2. Government science and technology departments should encourage and guide companies (especially small and medium-sized enterprises) to widely absorb new technologies and achievements in rural areas and various technical services using various means to enhance their market competitiveness.

3. Investment in the science and technology service industry is to be expanded using various approaches. Support the establishment of science and technology service businesses by research institutions, universities, and professional schools. Scientists and technologists may guide or establish various types of science and technology service institutions and enter the science and technology service industry in various ways, such as retirement or unpaid employment.

4. The science and technology service industry is an intellectual-intensive industry engaged in creative labor and is to enjoy preferential measures received by high-tech companies.

1. This was the first time the state clearly stated at the policy level that the science and technology service industry is an important part of modern service industries.

2. Against the backdrop of market economy system reform, it presents the positioning, main role, and principles of government support for the science and technology service industry, marking a groundbreaking move.

Regulation Name (Issuing Department and Implementation Date)	"Opinions on the Active Development of Science and Tech 大力发展科技中介机构的意见") (Ministry of Science and Technology, December 20, 2002	nnology Intermediary Agents" ("关于)
Main Content		Importance and Impact
 The development is to follow the develop socialization⁸², encour promoting the active e Intermediary Agents b 2. The main objecti Intermediary Agents i and policy and legal en various STIAs, to nurt services, scale develop specialized science and 	t guideline for Science and Technology Intermediary Agents pment directions of specialization, marketization, and aging the exploration and practice of various models and stablishment of various types of Science and Technology by social forces. ive of the development of Science and Technology s to build organizational structures, operational mechanisms, nvironments that contribute to the sound development of true a large number of STIAs equipped with professional oment, and standardized operations, and to form highly d technology intermediary service teams.	 Clarifies the scope of Science and Technology Intermediary Agents, conceptually defines their meaning and scope for the first time, and lists specific institutions' names and functions, and indicates the direction of industry development. Clearly defines the main role of Science and Technology Intermediary Agents in the transformation of scientific and technological achievements and goal achievement. Namely, Science and Technology Intermediary Agents need to intervene in the process of transforming scientific and technological achievements and enhance the speed of transformation.

⁸² Socialization refers to the process in which individuals (entities) learn and acquire social behaviors and personal characteristics such as knowledge, skills, language, norms, and values within a specific socio-cultural environment, adapt to society, actively contribute, and create new cultures.

Regulation Name
(Issuing Department
and Implementation
Date)
Date)

"National Medium and Long-term Science and Technology Development Plan Outline (2006 - 2020)" ("国家中长期科学和技术发展规划纲要(2006 - 2020年)") (State Council, December 20, 2005)

1. Start by serving national goals and mobilizing the enthusiasm and creativity of science and technology personnel, focus on promoting the efficient allocation and comprehensive integration of science and technology resources across society, and comprehensively advance the construction of a national innovation system with Chinese characteristics through the construction of a technology innovation system led by enterprises and integrating industry, academia, and research, significantly enhancing the country's independent innovation capability.

2. Construct a sound national macro-regulation mechanism for science and technology. Form a policy system where the country's science and technology policies and economic policies are coordinated and linked Establish an adjustment mechanism for coordinating the allocation of science and technology resources across departments. Enhance macro-management capabilities and service levels, improve program management methods, and fully leverage the roles of departments and localities in program management and project implementation management.

3. The national innovation system is to be a social system where the government takes the lead, fully utilizes the fundamental functions of the market in resource allocation, and various science and technology innovation entities closely cooperate and effectively interact. With enterprises as leaders, integrate industry, academia, and research into a technology innovation system as a breakthrough in promoting the construction of the national innovation system.

4. Build a socialized and networked science and technology intermediary service system. Actively nurture and develop various Science and Technology Intermediary Agents to address unresolved issues such as the small scale of the science and technology intermediary service industry, singular functionality, and weak service capabilities. Fully leverage the important roles of higher education institutions, research and development institutions, and various organizations in science and technology intermediary services. Guide the development of Science and Technology Intermediary Agents towards specialization, scale, and standardization.

5. Build information platforms for technology exchange and technology transactions and provide policy support for the technology development and service activities conducted by Science and Technology Intermediary Agents such as university science and technology parks, incubation bases, productivity promotion centers, and technology transfer centers.

1. In autonomous innovation, enterprises are treated as the main entities of technological innovation, with a common understanding formed on important issues such as the construction of the innovation system and clarifying that autonomy and marketization are the directions of autonomous innovation.

2. The plan defines the existence of the science and technology service industry from a global, long-term, and future perspective, solidifying the foundation for designing the framework of the science and technology service industry, refining duties, and organizing and compiling policies.

Regulation Name (Issuing Department and Implementation Date)	Management Measures for National Technology Transfer 1 术转移示范机构管理办法") (Ministry of Science and Technology, September 10, 2007	Demonstration Institutions ("国家技)
Main Content		Importance and Impact
 Technology transservices such as technology investite that merely provide into 2. The main function flow of knowledge and work: (1) Collection, see (2) Technology transferse secondary developments tandards, testing and evaluation, technology bidding, tetechnology bidding, tetechnology transaction businesses related to particle of regional tections to provide of technology transfer. En organizations, support towards specialization centered around one of 4. The science and Council are responsible institutions with strong models. They arrange technology transfer de these institutions. 	sfer organizations are defined as agencies that provide various ology management, integration and operation of technology, ment and financing services. They do not include agencies formation, legal, consulting, and financial services. on of technology transfer organizations is to facilitate the the transfer of technology. They have the following scope of election, analysis, and processing of technology information, r and agency services, (3) Technology integration and nt, (4) Pilot testing, engineering design services, technology analysis services, etc., (5) Technology consulting, technology r training, technology property rights transactions, chnology investment and financing services, (6) Providing n information service platforms and networks, (7) Other romoting technology exchange service institutions are to play hnology exchange hubs, using public information service ne-stop, networked public services for the entire process of neourage the establishment of specialized technology transfer existing technology fields. technology administrative departments of the State e for managing national technology transfer demonstration service capabilities, outstanding achievements and clear technology transfer funds in the national science and dize the practical work of technology transfer by national monstration institutions, and support the capacity building of	 Promotes the flow of knowledge and technology transfer by exploring and improving the country's technology transfer system and effective operational mechanisms through clarification of concepts and operational content. Guides the market-oriented and standardized development of technology transfer organizations through financial incentives and policy encouragement.

Regulation Name (Issuing Department and Implementation Date)	National Technology Transfer Promotion Action Implemen 实施方案") (Ministry of Science and Technology, September 19, 2007	ntation Plan ("国家技术转移促进行动)
Main Content		Importance and Impact

1. Build a new type of technology transfer system, seeking operational mechanisms and effective methods conducive to technology transfer and dissemination.

2. Serve as a service provider for technology transfer, exploring and innovating service models, enhancing professional service capabilities, and establishing service brands. Integrate diverse resources to provide full-process services for technology transfer.

3. Improve the regulatory and policy framework related to the technology market, creating a favorable legal environment for technology transfer. Consider the formulation of State Council regulations on promoting technology transfer, clarifying the positioning and functions of various entities involved in technology transfer. Standardize technology transfer activities, maintain the order of the technology market, protect intellectual property rights, and promote the flow of knowledge and technology transfer. Examine and introduce regulations on the publication standards for technology and technology service information, management of national technology transfer demonstration organizations, management of technology brokers⁸³, and review of major technology transfer related professions and positions. Localities are encouraged to manage the qualifications of technology brokers and to strengthen the training of technology brokers working in technology transfer organizations.

4. Promote further integration of technology and capital, establishing and improving the investment and financing service system for technology transfer. Support technology transfer and industrialization through direct and indirect investments by social capital, venture capital, and financial credit.

1. Contributes to the construction of policy and institutional environments for technology transfer from a macro perspective.

2. Ensures the foundation for technology transfer is created in alignment with the autonomous innovation strategy.

3. Through interaction and coordination between government and market, the plan has stakeholders in technology transfers position themselves and play roles in achieving objectives.

83 Technology brokers (技術経紀人) are natural persons, legal persons, or other organizations that provide intermediation, brokerage, or representation in the technology market to facilitate the transformation of achievements, receiving appropriate fees for their services.

Regulation Name (Issuing Department and Implementation Date)	"Several Opinions on Accelerating the Development of th Industry" ("关于加快科技服务业发展的若干意见") (State Council, October 28, 2014)	e Science and Technology Service
Main Content		Importance and Impact
 Focus on the dep technology services su and inspection, incuba consulting, science and technology, enhancing and supporting science Guide social cap science and technology shares. 	loyment of specialized and comprehensive science and ch as research and development, technology transfer, testing tion, intellectual property rights, science and technology d technology finance, and dissemination of science and the capacity of the science and technology service industry e and technology innovation and industrial development. ital to participate in the reorganization of state-owned y service enterprises and promote the diversification of	 The specialization, networking, scaling, and internationalization of the science and technology service industry provide an important guarantee for innovation-oriented national construction and the upgrading of the Chinese economy. This was the State Council's first comprehensive plan for the development of the science and technology service industry. Regions are required to formulate specific implementation plans, refine policy measures, and establish operational norms for regulatory and enforcement departments to ensure the healthy development of the science and technology service industry. Participation from social capital can enhance the service functions of intermediary institutions and the status of market players, allowing for market-based improvements as one direction of reform.
Regulation Name (Issuing Department and Implementation Date)	ne National Science and Technology Service Industry Statistical Classification (2015) ("国家科技服 tment 务业统计分类 (2015)") ation (National Bureau of Statistics, April 17, 2015)	
Main Content		Importance and Impact
1. The scope of the into seven categories: professional technical services, science and t financial services, scie services, and compreh 2. This classification	science and technology service industry is broadly divided scientific research and experimental development services, services, science and technology promotion and related echnology information services, science and technology nce and technology dissemination, publicity, and education ensive science and technology services.	 Clarifies the classification of the science and technology service industry based on "Several Opinions on Accelerating the Development of the Science and Technology Service Industry." Serves as the framework

2. This classification, based on the key tasks indicated in "Several Opinions on
Accelerating the Development of the Science and Technology Service Industry,"
defines the basic scope of the science and technology service industry.2. Serves as the framework
for subsequent reforms, including
revisions in 2018.

Regulation Name (Issuing Department and Implementation Date)	"Law on Promoting the Transformation of Scientific and T 技成果转化法") (Standing Committee of the National People's Congress, C	Technological Achievements" ("促进科 October 1, 2015)
Main Content		Importance and Impact
1. The state establishes and improves the science and technology reporting system and the information system for scientific and technological achievements,		1. Creates a favorable environment for the transfer and transformation

system and the information system for scientific and technological achievements publicizes information on the implementation status of science and technology projects, achievements, and related intellectual property rights to society, and provides public services such as inquiries and reviews of scientific and technological achievements.

2. Decentralize rights related to the disposal, use, and management of scientific and technological achievements.

3. Strengthen the primary role of enterprises in the transformation of scientific and technological achievements. Positions the market as the main means of optimizing the allocation of innovation resources, with enterprises as the protagonists of technological innovation.

4. The state cultivates and develops the technology market, encourages the establishment of Science and Technology Intermediary Agents, and provides places for technology transactions, information platforms, and services such as information searches, processing, analysis, evaluation, and management.

5. The state supports the development of incubators, university science and technology parks, etc., providing services such as incubation space, startup counseling, and research and development and management consulting for early-stage science and technology-type small and medium-sized enterprises.

1. Creates a favorable environment for the transfer and transformation of scientific and technological achievements. Evaluates the performance of the transformation of scientific and technological achievements, using the results as a basis for organizational support, providing incentives to enhance the growth and potential of technology services.

2. Proposes that technology transfer can be conducted through technology transfer work organizations or independent scientific and technological achievement transformation service institutions to maximize the benefits of these achievements.

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Regulation Name (Issuing Department and Implementation Date)	"Action Plan for Promoting the Transfer and Transformation Achievements" ("促进科技成果转移转化行动方案") (State Council, April 21, 2016)	on of Scientific and Technological
Main Content		Importance and Impact
 Construct a national chievements. Publicity and related intellectual information searches a 2. Support the transachievements. Realize through various method converting scientific a ratios. Build a national transfer service organizes research and developm innovation factors such 4. Platforms based adhering to an open aristitutions to provide financing and M&A, It 5. Strive to enhance institutions. Support la improving regional an 6. Improve the servithe functions of variou and intellectual proper between scientific and service or scientific and service or scientific and service the functions of variou and intellectual proper between scientific and service and scientific and scientifi	anal information system for scientific and technological e information on scientific and technological achievements l property rights to society, providing public services such as and reviews of scientific and technological achievements. sfer and transformation of scientific and technological the market value of scientific and technological achievements ds such as technology transfer, technology licensing, and nd technological achievements into shares or investment technology transaction network platform. Link technology zations, investment and financing institutions, universities, nent institutions, and enterprises, aggregating various n as achievements, capital, talent, services, and policies. on specialized institutions operate with a market orientation, ad shared operating philosophy, supporting various service specialized services such as information dissemination, isting, bidding and auction, consulting, and counseling. e the health of regional technology transfer service ocalities and relevant institutions in establishing and d industry-specific technology transfer organizations. Enhance as platforms such as technology property rights transactions ty rights transactions, promoting effective integration technological achievements and capital.	 Established channels between science and technology and the economy, to lay down a systemic foundation. Through the guidelines of the action program, organizations strengthen the implementation of policies and improve specific operational methods, enhancing the effectiveness of the transformation of achievements. Efforts from the supply side, demand side, and service side are made simultaneously to design the overall factors and deploy an entire chain, building a comprehensive system of services to support the transformation of achievements. Clarifies policy directions such as establishing a sound science and technology reporting system, a national information system for scientific and technological achievements, and sub-funds for venture capital.

Regulation Name	"Nati
(Issuing Department	(State
and Implementation	
Date)	

"National Innovation-Driven Development Strategy Outline" ("国家创新驱动发展战略纲要") (State Council, May 20, 2016)

Main Content		Importance and Impact
1. Scientific and technolo comprehensive innovations	ogical innovation, accompanied and promoted by such as management innovation, organizational	1. The "Outline" emphasizes strategic, ideological, and systematic
innovation, and business mo	odel innovation, becomes a new engine for innovation-	aspects as a top-level document.
driven development, signific	cantly enhancing the capacity of science and technology	It indicates the direction of

driving force for development.2. It is necessary to build an ecosystem where all innovation entities interact, innovation factors flow smoothly and are efficiently allocated, further clarifying the roles of government and market, and constructing mechanisms for the coordinated allocation of innovation resources.

to guide economic and social development, and making innovation the primary

3. Resource allocation is to be shifted from research and developmentcentric to an integrated distribution along the industrial chain, innovation chain, and capital chain. The innovation complex is transitioning to a situation where minorities (scientists and engineers) and the masses interact in innovation and entrepreneurship to produce transformation.

4. The direction of development is to be towards "new-type research and development institutions" that are market-oriented. The focus is to be on the key technological needs of regions and industries, implementing diversified investments, diverse methods, market-oriented operations, and developing various forms of advanced technology research and development institutions, as well as institutions for the transformation of results and industrial incubation.

5. A specialized technology transfer service system is to be built. Various scientific and technological services such as research and development / design, intermediate inspection improvements, incubation, testing & certification, and intellectual property rights are to be developed. The national technology transaction market system is to be improved, and a standardized, specialized, market-oriented, and networked technology and intellectual property transaction platform is to be developed. Research institutions and universities are to establish specialized technology transfer organizations and professional technology transfer personnel teams to smooth the channels of technology transfer.

6. Modern information technologies such as mobile internet, big data, cloud computing are to be used to develop new entrepreneurial service models and establish various forms of incubation institutions, building an incubation + venture capital entrepreneurial model. Decentralized and networked innovation is to be promoted, business model innovation in companies is to be encouraged, and social capital guided to participate in the construction of socialized technology innovation public service platforms for small and medium-sized enterprises.

It indicates the direction of development for the scientific and technological service industry. 2. It clarifies the positioning and objectives of the scientific and technological service industry in the innovation system to address the new trend of diversification of innovation subjects and activities, and routes,

and to fundamentally rationalize the

innovation governance system.

Regulation Name (Issuing Department and Implementation Date)	"National Science and Technology Incubator '13th Five-Ye 业孵化器"十三五"发展规划") (Ministry of Science and Technology, June 29, 2017)	ear' Development Plan'' ("国家科技企
Main Content		Importance and Impact
 Market-led, gove constructing incubator capital and lending ser allocation. Diverse coexiste of incubators' construe 3. Enhancement of resources becoming a technology, strengther processes, specializati customization of incut 4. Services for the entrepreneurship such genres), promote the tr further develop the rea 5. Scientific evalua and rational evaluatior and classification guid incubators. 	ernment-guided: Focus on nurturing entrepreneurial entities, rs, providing entrepreneurial services, and expanding venture vices, with the market to play a decisive role in resource nce and synergistic development: Maintain the diversification ction entities and operation mechanisms. services and sustained innovation: Promote incubation fundamental matter, the capitalization of innovation ting of incubation capital, chains between incubation on of service actions, an ecology of service factors, and bation processes. masses: Create conditions for new types of innovation and as "Internet +" and crossover integration (fusion of different ransformation and upgrade of traditional industries, and al economy ⁸⁴ . tion and classification guidance: Play the role of a scientific and tracking surveillance system, strengthen grading ance, and promote performance improvements amongst	 Clarifies the role of incubators as the backbone of the entire incubation chain of "Group Innovation Space- Incubator-Accelerator" and builds a healthy service succession promotion mechanism through system design. Encourages the flexible application of new models such as crowdsourcing, crowdfunding, crowd innovation, crowd support, the construction of new types of incubators, and promotes the continuous emergence of entrepreneurial achievements amongst new enterprises, new formats, and new business models. Helps construct an investment service system inclined towards incubation and builds an institutional foundation to promote the integrated development of investment and incubation.

⁸⁴ Economic activities that involve specific compensation for money, such as the production and sale of goods and services, or capital investment.

Regulation Name (Issuing Department and Implementation Date)	"National Science and Technology Innovation Base Optim 科技创新基地优化整合方案") (Ministry of Science and Technology, August 18, 2017)	iization and Integration Plan" ("国家
Main Content		Importance and Impact
 The positioning of under technology innot the country's economi society, and the constr demonstrations, result autonomous innovatio progress. The National Tec existing national-level sectors that impact the research and developm transformation and ap Resource allocat classification support a between performance decisive role of market and technology innova transform achievemen party evaluation and a subsidies to support the 	of national science and technology innovation bases (classified wation and results transformation) is to tackle the needs of c and social development, the governance of an innovation uction of a safe and secure China, promoting applied s transformation, and industrialization, as well as enhancing n capabilities and the level of scientific and technological chnology Innovation Center, which optimizes and adjusts bases, primarily addresses the needs of industries and c country's long-term development and stability, conducting nent of generic core technologies and products, as well as the plication demonstration of results. ion mechanisms are to be improved. Improve the methods of and stable support mechanisms, strengthen the connection evaluation and financial support, and fully utilize the t-allocated resources in the construction of national science ation bases classified to produce technological innovation and ts. Furthermore, strengthen government guidance and third- ssessment, and based on this, adopt methods such as post- e capacity enhancement of each base.	 China demonstrates representative examples of technology results transformation and industrialization, which serve as a model for the development of other scientific and technological service institutions. Resource allocation combining market principles and government- led incentives has become the development model for local scientific and technological service organizations.

Regulation Name		
(Issuing Department		
and Implementation		
Date)		

"National Technology Transfer System Construction Plan" ("国家技术转移体系建设方案") (State Council, September 26, 2017)

Main Content	Importance and Impact
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1. The national technology transfer system is designed to promote the continuous production of scientific and technological achievements, facilitating the dissemination, flow, sharing, and application of scientific and technological achievements, as well as realizing an ecosystem with economic and social value.

2. The market is to play a decisive role in promoting technology transfer, accelerating the penetration and dissemination of science and technology, and promoting the optimal allocation of innovation factors. By 2020, a national technology transfer system adapted to new situations is to be constructed and the initial stages of an interconnected technology market are to be formed.

3. A unified and open technology market is to be established. An interconnected nationwide technology transaction network is to be constructed. Linkage and integration between the technology market and the capital market are to be promoted, expanding channels for various capital to participate in technology transfer investment, circulation, and exit.

4. Accelerate the establishment of socialized technology transfer organizations. Encourage various STIAs to provide professional services such as intellectual property rights, legal consultations, asset evaluations, and technology evaluations through technology transfer. Guide various innovation entities and technology transfer organizations to jointly launch technology transfer alliances, enhancing information sharing and business cooperation. Encourage regions with the necessary conditions to support related technology transfer organizations based on their service performance.

5. Improve various investment and financing services. National and local science and technology achievement transformation guidance funds are to direct social capital to strengthen investment and financing support for projects in the initial stages of technology transfer and for small and micro enterprises with outstanding science and technology, through the establishment of venture capital sub-funds and financing risk compensation. Experimentally implement intellectual property rights securitized financing, encouraging commercial banks to carry out intellectual property rights secured financing.

1. This plan first presented the concept of a national technology transfer system. A systematic promotion structure was built to accelerate the transformation of scientific and technological achievements into a realistic driving force for economic and social development.

2. Efforts were made to coordinate existing initiatives and various key points to promote the transfer and transformation of scientific and technological achievements. The plan also clarifies the direction of reforms to further promote the transfer and transformation of scientific and technological achievements, optimizing the policy environment. Thus, it clarifies China's strategic priorities for building a technology transfer system.

3. The flaws in the technology transfer chain were addressed, and vertical and horizontal technology transfer networks were formed. Fault tolerance⁸⁵ and trial-and-error mechanisms were improved, and long-term incentive mechanisms for scientific researchers were explored.

⁸⁵ Fault tolerance: The ability to continue functioning by switching to a backup system or other means in case of a component failure or shutdown.

Regulation Name (Issuing Department and Implementation Date)	"Specification for Technology Transfer Services" ("技术转移服务规范", National Standard of China GB/T34670-2017) (National Service Standardization Technical Committee, January 1, 2018)	
Main Content		Importance and Impact
1. General requirent technology developme services, technology e services, information n improvement.	nents for technology transfer services, application processes, ent services, technology services, technology consulting valuation services, technology investment and financing network platform services, service evaluation, and	 Expands the concept of technology transfer, guides the practices of technology transfer, directs the standardized development of technology transfer services, promotes the optimization of the structure of China's technology transfer system, enhances the overall effectiveness of the technology transfer system, and accelerates the integration of technology markets with capital, human resources, and other factor markets, having significant importance in stimulating new vitality for economic and social development. Promoting the quality and efficiency of the scientific and technological service industry and standardizing the implementation of technology transfer services hold significant importance.

Regulation Name (Issuing Department and Implementation Date)	"Several Opinions on the Development of the Technology 意见") (Ministry of Science and Technology, May 31, 2018)	Market" ("关于技术市场发展的若干
Main Content		Importance and Impact

1. Cultivate twenty high-level, expert technology transfer organizations to play a guiding role, cultivate 600 market and society-oriented technology transfer organizations, develop 3-5 hub-type technology transaction markets, train 10,000 technology agents and technology brokers, achieve a national technology contract volume of 2 trillion yuan, and significantly improve the quality and efficiency of technology transactions. By 2025, expand the development of a unified, open, functional, and institutionalized technology market.

2. Construct hub-type technology transaction markets and make them key points of the national technology transaction network. Improve regional technology transaction markets, promote scientific and technological achievements, and contribute to regional economic and social development. Have national regional centers for technology transfer achieve their roles, link various technology transaction markets and form an interconnected national technology transaction network.

3. Provide comprehensive support services such as intellectual property rights, legal consulting, technology evaluation, pilot incubation, bidding, and auction to both parties involved in technology transactions, constructing a nationwide hub-type technology transaction market.

4. Vigorously develop many socialized technology market service institutions, adopt market-oriented operation mechanisms, and provide professional services. Conduct technology market statistical surveys and data analysis and establish a sound special statistical system for technology transfer services.

5. Develop new types of technology transaction markets and service institutions that integrate online and offline, conduct activities such as innovation challenges, and aim for accurate matching with corporate needs.

1. Classified and developed various types of technology transaction markets, further clarified their functional positioning and service targets, and ultimately formed a nationwide interconnected technology transaction network.

2. Focused on the weaknesses of technology transactions, clarifying the direction of applying advanced technologies such as big data and cloud computing to improve transaction efficiency. Additionally, technology market service organizations are to be encouraged to provide services such as lump sum guarantees of large funds to both parties involved in technology transactions, strengthening the protection of credit and profits in technology transactions.

3. Through the improvement of top-level design systems at the national level, it promoted the overall layout and synergistic effects of the technology transaction market, forming synergy among technology transaction participants

Regulation Name (Issuing Department and Implementation Date)	"Science and Technology Business Incubator Management 办法") (Ministry of Science and Technology, January 01, 2019)	t Measures" ("科技企业孵化器管理
Date)		
Main Content		Importance and Impact

 Strengthen guidance for enhancing the capacity of incubators. Guide incubators to increase incubation intensity per unit area.
 Improve the technical content of incubated companies. Clarify the

requirements for incubated companies to possess research and development and technical service capabilities as science and technology-type small and mediumsized enterprises and increase the proportion of incubated companies with intellectual property rights.

3. Enhance requirements for incubators' investment and financing capabilities and increase incubation funds.

4. Reduce the number of graduated companies and raise the conditions for companies to graduate. Direct the cultivation of specialized incubators. Focus on difficult and remote areas.

5. Implement related requirements of Fangguanfu(放管服)⁸⁶. Adjust reporting methods and establish a clear responsibility system.

6. Expand social supervision. Expand efforts for social supervision through public notices at both local and national levels.

7. Guide the development of incubators towards specialization, eco-friendliness, market orientation, and internationalization. Require a 20% reduction for difficult and remote incubation sites in terms of area, number of incubated and graduated companies, scale of incubation funds, and proportion of intellectual property rights. Changes the review and evaluation method from centralized review and evaluation by the Ministry of Science and Technology Torch Center to evaluation and on-site inspection by experts organized by provincial science and technology administrative departments and review and judgment by the State Council's science and technology administrative departments.

1. Expands the scope of incubators to include technology incubators such as Group Innovation Spaces within the incubator management system.

2. Presented the fundamental concept of incubator development in the new era.

3. The provision of space and facilities for entrepreneurs and incubation services becomes the main reference criterion for evaluating the performance of incubators.

4. Incubators are elevated from a specialized to a strategic level, shifting the management of incubators from focusing on frontend accreditation to promoting high-quality development of the incubation industry.

⁸⁶ 放管服: Abbreviation for "simplifying administration and delegating powers," "integrating delegation and management," and "improving services."

Regulation Name (Issuing Department and Implementation Date)	"Opinions on Building a More Complete Factor Allocation Mechanism Based on Market Principles" ("关于构建更加完善的要素市场化配置体制机制的意见") (State Council, March 30, 2020)	
Main Content		Importance and Impact
1. Main principle: I allocation, open the ch production factors for factors according to m maximum effectivene: supervision and mana, policy classification. F the market and institut 2. Cultivate techno Strengthen the constru- Promote the integration explore methods to pro- achievements through securitization, science to adopt lending methor revenue collateral and technology transfer am	First, fully leverage the decisive role of the market in resource nannels for the flow of factors, ensure equal access to different market participants, and promote the allocation of arket rules, market prices, and market competition to achieve ss and optimal efficiency. Next, produce sound systems and gement innovation. Lastly, focus on problem orientation and ocus on the limited scope of factor allocation determined by tional barriers to factor mobility. logy transfer organizations and technology managers. action of national technology transfer regional centers. In and development of technology and capital factors. Actively pomote the capitalization of scientific and technological angel investment, venture capital, intellectual property and technology insurance, etc. Encourage commercial banks ods such as intellectual property collateral and expected provide more financial products and services to promote d transformation.	1. The technology market is an important factor market, and this establishes the direction, goals, and missions for the development of China's technology market in the new stage.

Regulation Name (Issuing Department and Implementation Date)	The 14th Five-Year Plan and the Long-Range Objectives fo 景目标纲要") (National People's Congress, March 11, 2021)	or 2035 (""十四五"规划和2035 年远
Main Content		Importance and Impact

1. Comprehensive policies such as research and development expense deductions. Major projects are to play a leading role, with government procurement policies used to support innovation products and services. Corporate innovation capacity is to be enhanced through improvements in standards, quality, and competition regulation.

2. Promote innovation and entrepreneurship institution reform, constructing specialized market-oriented technology transfer organizations and technology manager teams. Improve the financial support system for innovation, encouraging financial institutions to develop science and technology financial products such as intellectual property secured financing and science and technology insurance, and implement pilot projects for lending risk compensation for the transformation of scientific and technological achievements.

3. Accelerate the establishment of laws in new fields and formats related to intellectual property rights. Optimize patent assistance incentive measures and examination and evaluation systems, protect high-value patents while providing incentives, and cultivate patent-intensive industries.

1. Emphasizes the role of market mechanisms, guides the active participation of social capital through diverse capital investment systems, and expands the scope of service groups by allowing more companies to enter the science and technology service industry.

2. Expands and steadily grow the benefits of Science and Technology Intermediary Agents through fiscal policy. Also, enables more companies with potential, qualities, and capabilities to participate in the development of Science and Technology Intermediary Agents and expand the market share of these Agents.

3. Expands the business scope of scientific and technological service institutions through accurate support for patents and other means, leaving room for policy-making that combines the practicality and social nature of new industrial technology products such as artificial intelligence.

Department and mplementation Date)	(National People's Congress, January 1, 2022)	
Main Content		Importance and Impact
Department and mplementation Date) Main Content	(National People's Congress, January 1, 2022)	Importance and Impa

1. The nation will encourage the mutual integration of research and development in science and technology with higher education and industrial development, as well as interdisciplinary integration and mutual promotion among academic fields. The nation will strengthen cooperation among regions, industries, and fields in science and technology.

2. The nation will encourage the integrated development of result transformation. The nation will improve the common basic technology supply system, promote the strong integration of the innovation chain and industrial chain, and ensure the safety of industrial and supply chains.

3. The nation will establish and improve research and development coordination mechanisms, focus on significant needs for economic and social development, national security, and the health and life of the people, enhance the integrated allocation of projects, talents, bases, and funds in key areas, promote close cooperation among industry, academia, and research, and advance autonomous management of critical core technologies.

4. The nation will encourage enterprises, research institutions, universities, and other organizations to build cooperative mechanisms based on mutual complementation, clear role division, result sharing, and risk sharing. Furthermore, based on market mechanisms, research and development platforms, technology innovation federations, and innovation consortia will be jointly established to promote joint research and development and the transformation of scientific and technological achievements, improving the effectiveness of the transfer and transformation of scientific and technological achievements.

5. The nation will improve capital markets at various levels, establish a sound mechanism to promote scientific and technological innovation, and support science and technology-type companies that meet criteria to use the capital market to promote their own development.

6. The nation will strengthen guidance and policy support, expand sources of venture capital through multiple channels, and support the development of entrepreneurship. The nation will improve the market listing and financing systems for science and technology-type companies, open domestic listing and financing routes for these companies, and utilize the financing functionality of the capital market to aid scientific and technology innovation.

1. The second revision of the Law of the People's Republic of China on Progress of Science and Technology focused on the challenge of highquality development, becoming a fundamental law in the field of science and technology.

2. It improved the existing national innovation system, added new chapters on regional science and technology innovation, international science and technology cooperation, supervision and management, and strengthened the institutional mechanism for new types of science and technology innovation.

3. It comprehensively explains in detail the positioning and targets effort for scientific and technological intermediary services such as science technology transformation and financial support, indicating the direction for the formulation of subordinate regulations.

Regulation Name (Issuing Department and Implementation Date)	"14th Five-Year Plan for the Special Plan of the Technology 市场专项规划") (Ministry of Science and Technology, September 30, 2022)	y Factor Market" ("十四五" 技术要素
Main Content		Importance and Impact
 Specific goals: I rights and scientific a organizations: China and Shenzhen Stock I 5 trillion yuan. Estab transfer and transforr regional centers, 500 technology transfer c Utilize the eval financial investment. Support the esta property rights tradir 4. Consider finance scientific and technol 	Essentially complete the three national intellectual property nd technological achievements property rights exchange Technology Exchange, Shanghai Technology Exchange, Exchange. The volume of technology contracts is to reach lish 20 national scientific and technological achievements nation demonstration zones, 15 national technology transfer national technology transfer organizations, 60 international enters, and more than 30,000 technology agents. uation of scientific and technological achievements for ablishment of intellectual property rights and intellectual ag centers for scientific and technological achievements. ial support methods at various points of the transformation of ogical achievements.	 The goals presented in this plan are to realize clearly defined property rights and market-determined prices, avoiding a narrow understanding of the technology market as merely a technology trading market, and understanding the technology market from the perspective of market allocation of technology factors. Challenges such as promoting the integration of factors and accelerating cross-border flows are advantageous in complementing the shortcomings and weaknesses in the development of the technology market. A series of pilot projects in key areas and critical points, such as the implementation of a project agent system and owner system and the promotion of cross-border flows of innovation factors, align with the general expectations of all societal layers.
2. Local Government Policies

(1) Beijing

Regulation Name
(Issuing Department and
Implementation Date)"Beijing Municipal Technology Market Regulations" ("北京市技术市场条例")
(Beijing Municipal People's Congress Standing Committee, July 18, 2002)

Main Content

1. Natural persons, legal persons, and unincorporated organizations that engage in technology development, technology transfer, technology licensing, technology consulting, technology services, and other technology transaction activities and activities related to the technology market within the administrative region of the city are subject to this regulation.

2. The city's science and technology department has jurisdiction over the city's technology market, and the Beijing Technology Market Management Office is responsible for the management and supervision activities of the technology market under the guidance of the city's science and technology department.

3. In technology transaction activities, the seller must be the legal owner of the provided technology and guarantee the authenticity of the provided technology. Intermediaries should guarantee the credibility of the provided technology information and the legitimacy of its sources. The buyer shall pay the usage fee for the technology agreed upon in the contract.

4. Parties to a transaction can transact directly or through intermediaries. Technology transactions can be conducted through bidding or auction, etc. For scientific and technological projects mainly funded by government finance, bidding should be conducted if appropriate. Technology transactions can be conducted over the Internet.

5. The city will establish and improve a professional, social, and networked technology transaction service system. The establishment of various intermediary service organizations for technology transactions will be encouraged, providing services such as venues, technology information, technology certification, technology evaluation, technology mediation, technology property rights transactions, and technology bidding agencies.

6. According to this regulation, a technology broker refers to a natural person, corporation, or unincorporated organization that engages in mediation, commission, or agency activities to facilitate others' technology transactions and receives a proper fee for these services. Individuals engaged in technology mediation must be trained. Organizations engaged in technology mediation must conduct related procedures in accordance with domestic regulations. The city will establish Technology Property Right Exchange Organizations that, in accordance with the law, engage in mergers and acquisitions activities including investment in technological achievements, transfer of property rights of high-tech companies, capital increases, and technological participation in high-tech enterprises, thereby promoting the integration of technological achievements and capital.

7. These organizations can certify and register contracts according to their type, which is determined based on the content, including those involving technology development, technology transfer, technology licensing, technology consulting, and technology services, as well as contracts based on technology property rights transactions.

Regulation Name	"Several Opinions on Further Strengthening the Construction of Beijing's Science and
(Issuing Department and	Technology Incubation System" ("北京市关于进一步加强科技孵化体系建设的若干意见")
Implementation Date)	(Beijing Science and Technology Commission, December 24, 2010)

1. The science and technology incubation system is an essential component of the capital's regional innovation system and the organizational system for the transformation and industrialization of scientific and technological achievements. Specifically, it is a system that promotes scientific and technological innovation and entrepreneurship, formed by various types of incubators that organically combine the principles of market economy, venture capital markets, intermediary service organizations, and other innovation resources. This includes incubators, university science and technology parks, overseas student entrepreneurship parks, accelerators, and university student entrepreneurship practice bases.

2. Incubators are to be encouraged and the modern enterprise system is to be improved. Incubators are to use market-based means to innovate the integration mechanism of various incubation service resources, contributing to the development of science and technology-type small and medium-sized enterprises.

3. Incubators are to encourage strengthened capacity building in venture capital. Incubators must be encouraged to establish incubation seed funds, provide investment and financing services to incubated companies, and jointly establish market-oriented business incubation investment funds with venture capital institutions, corporate groups, and other social capital.

4. Incubators must be encouraged to perform entrepreneurship consulting services. Incubators must improve the entrepreneurship guidance system to provide specialized consulting services for science and technology-type small and medium-sized enterprises in technology product development, production operation management, market channel construction, and comprehensive development strategies.

5. Cooperation between incubators and specialized technology transfer organizations is to be encouraged. Incubators should train specialized technology intermediary service personnel and cooperate with various specialized institutions such as technology market organizations, technology transfer centers, and technology property exchanges to provide technology transfer services that meet the needs of incubated companies for technology buying and selling.

Regulation Name	"Guiding Opinions of Beijing Municipal People's Government on Further Promoting the
(Issuing Department and	Transformation and Industrialization of Scientific and Technological Achievements" ("北京市
Implementation Date)	人民政府关于进一步促进科技成果转化和产业化的指导意见")
	(Beijing Municipal People's Government, March 15, 2011)

1. Fully utilize the leading role of the government and the basic role of the market in resource allocation, make effective use of the resources of the central government located in Beijing, and promote the transformation and industrialization of scientific and technological achievements. Emphasize system innovation, fully exploit the advantages of pilot projects in Zhongguancun National Independent Innovation Demonstration Zone and create a breakthrough to solve deeprooted contradictions and problems constraining the transformation and industrialization of scientific and technological achievements.

2. Deepen early and experimental innovation pilot projects and seek breakthroughs in institutional barriers to the transformation and industrialization of scientific and technological achievements.

3. The government is to fully play a leading role and strongly promote the innovation of mechanisms and models for the transformation and industrialization of scientific and technological achievements. Taking Zhongguancun National Innovation Demonstration Zone as an important venue, the capital's innovation resource platform is to be built, the innovation resources of the capital's universities, research and development institutions, central enterprises, high-tech companies, etc., are to be further integrated, and a cross-level joint review and approval model is to be adopted in addition to dealing with "special cases with special methods." Various early and experimental reform policies agreed upon by the State Council are also to be steadily implemented.

4. The basic role of the market is to be fully utilized in the allocation of scientific and technological resources, and efforts are to be devoted to preparing a market environment conducive to the transformation and industrialization of scientific and technological achievements. Numerous specialized achievement transformation service organizations are to be produced. The accumulation of innovation factors in enterprises through market mechanisms is to be promoted. The role of private science and technology enterprises in the transformation of scientific and technological achievements is to be fully utilized.
5. An environment for science and technology financial services is to be prepared. The market linkage mechanisms between science and technology-type companies and bank loans, science and technology insurance, and the capital market are to be improved.

6. Legislative procedures are to be advanced. After summarizing the experiences of policy pilot projects in Zhongguancun National Independent Innovation Demonstration Zone, accelerate preparatory work related to the formulation of local regulations on promoting the transformation and industrialization of scientific and technological achievements in the city

Regulation Name	"Guiding Opinions on Further Promoting the Development of the Science and Technology
(Issuing Department and	Service Industry" ("进一步促进科技服务业发展的指导意见")
Implementation Date)	(Beijing Science and Technology Commission, February 13, 2012)

1. During the 12th Five-Year Plan period, focus on promoting the rapid development of research and development services, design services, engineering technology services, and technology intermediary services, and on cultivating a number of key enterprises of a certain scale, small and medium-sized enterprises with distinctive proprietary technologies, and science and technology service organizations with market capabilities.

2. Implement a research and development service enterprise cultivation program, focusing on cultivating a large number of research and development service enterprises with strong innovation capabilities, excellent technical strength, and a certain amount of industry influence.

3. The design service industry is to be majorly developed. The "Guiding Opinions of Beijing City on Promoting the Development of the Design Industry," are to be steadily implemented, the "Capital City Design Industry Upgrade Plan," is to be executed, with industries such as industrial design, architectural design, computer animation design, etc., to be energetically developed. The integration of design in traditional industries, products, and services is also to be strengthened.
4. Specialized development in the science and technology intermediary service industry is to be pursued. The capabilities of technology transfer, science and technology incubation, productivity promotion, consulting services, etc., are to be utilized to promote the development of organizations in science and technology consulting, intellectual property services, technology integration, standardization services, etc., and specialized services are to be promoted through the entire process of science and technology innovation.

5. Science and technology service resources are to be effectively utilized. The development of science and technology finance is to be promoted, and multi-level capital markets utilized to further draw out the effectiveness of science and technology resources. The operating mechanism of the capital's science and technology platform is to be improved, emphasizing support for the open application of science and technology service resources, a third-party hosting model is to be explored, and the activation of resources is to be realized. Research and development institutions, important laboratories, and engineering technology research centers that meet certain conditions are to be encouraged to establish an open operational mechanism for providing market-oriented science and technology services.

6. The sustainability of the science and technology service industry is to be enhanced. Enterprises, research and development institutions, and universities are to be encouraged to establish science and technology service organizations with independent corporate status in various forms such as through intangible assets and joint construction.

Regulation Name	"Opinions from the Beijing Municipal People's Government on Accelerating the Development
(Issuing Department and	of the Capital's Science and Technology Service Industry" ("北京市人民政府关于加快首都科
Implementation Date)	技服务业发展的实施意见")
	(Beijing Municipal People's Government, May 12, 2015)

1. The market's decisive role in resource allocation is to be fully leveraged to actively promote the development of the science and technology service industry towards specialization, networking, scaling, and internationalization. By 2020, the market orientation of the capital's science and technology service resources is to be further improved, fundamentally forming an innovation-driven science and technology service system, while significantly enhancing support service capabilities for the transformation and application of scientific and technological achievements. Core enterprises, service organizations, and famous brands in the science and technology service industry with international influence are to be increased in number. In addition to clear positioning and rational arrangement, a science and technology service industry cluster is to be formed and synergistically developed. The city's science and technology service industry revenue is to reach 1.5 trillion yuan, and the technology contract transaction amount is to reach 500 billion yuan.

2. The advantages of research and development services are to be expanded. The orderly development of various emerging technology innovation institutions and new market-oriented research and development organizations is to be guided. The development of new research and development service industries using the Internet is to be encouraged.

3. Technology transfer services are to be efficiently conducted. Universities and research and development institutions are to be encouraged to establish technology transfer service organizations, conducting technology transfer and transformation activities through methods such as transfer, licensing, and equity evaluation. The market price mechanism is to be improved and amended. Technology transfer service organizations are to innovate their service models and provide support for the active deployment of new services based on modern information technologies such as big data, cloud computing, and mobile internet.

4. The development of the intellectual property rights service industry is to be promoted. Policies supporting the development of the intellectual property rights service industry are to be improved, and the interface between intellectual property rights services and policies in industry, science and technology, finance, etc., is to be strengthened.

5. The incubation service system is to be improved. Angel investors, etc., are to be encouraged to invest in the establishment of various types of incubators. The network of incubation services is to be improved and focus placed on developing core incubation models and new types of incubation methods based on the internet through incubation investment. The role of Zhongguancun Entrepreneurship Street⁸⁷, is to be leveraged and an incubation service chain of "entrepreneurial nursery-incubator-accelerator-industrial park" is to be constructed.

6. Innovation in science and technology financial services is to be deepened. The establishment of angel investment, venture capital, and guidance funds for the transformation of scientific and technological achievements is to be supported, and internationally renowned risk investment institutions are to be attracted to Beijing. Financial institutions are to be encouraged and guided to innovate financial products and service methods suited to the characteristics of science and technology-type enterprises, and to deepen various science and technology credit innovation pilot projects such as credit loans, equity collateral loans, intellectual property rights collateral loans, credit insurance, trade financing, and industrial chain financing.

7. The development of the design service industry is to be promoted. The Capital Design Upgrade Plan is to be implemented, and the close integration of design services with strategic emerging industries, urban planning, construction management, etc., is to be promoted. The construction of national design service platforms and a Chinese design trading market is to be supported, the design industry chain is to be improved, and the public is to be provided with personalized, diversified design services.

8. The development of market-based testing and certification services is to be supported. Industry integration and mergers and acquisitions across layers and sectors are to be promoted, and support for the independent corporate operation, enterprise transformation, and system reform of third-party inspection, testing, and certification institutions is to be provided.

9. The development of science and technology consulting and science dissemination services is to be promoted. Science and technology consulting companies are to be guided to use modern information and network technologies to develop new types of consulting services such as specialized consulting on business data, precision marketing, knowledge management, etc.

⁸⁷ Zhongguancun Entrepreneurship Street: Officially opened on June 12, 2014, and has gone through three development stages: adjustment, organizational aggregation, and innovation upgrade, to reach its current state. It has amassed various factors such as policy support, specialized entrepreneurial service intermediaries, investment, intellectual property management, training, etc., in one place, providing specialized support to technology entrepreneurs and startup teams. Young entrepreneurs can receive support necessary for entrepreneurship, such as low-cost office space, rapid administrative approval procedures, systematic service consultations, professional training, comprehensive financial assistance, etc. Its 200-meter-long, 10-meter-wide avenue houses more than 20 startup service organizations and has incubated 400 startup teams.

Regulation Name (Issuing Department and Implementation Date)	 "Implementation Measures for Promoting Scientific and Technological Financial Innovation and Supporting the Transformation and Industrialization of Scientific and Technological Achievements of Research Institutions in Beijing" ("北京市推动科技金融创新支持科研机构 科技成果转化和产业化的实施办法") (Beijing Science and Technology Commission, June 4, 2015)

1. Financial institutions, investment institutions, and specialized and comprehensive science and technology financial service institutions are to be encouraged to implement innovations such as angel investment, venture capital, science and technology loans, loan guarantees, financial leasing, science and technology insurance, multi-level capital markets, and intermediary services, and to provide services and support for the transformation and industrialization of scientific and technological achievements of research institutions. Angel investment institutions and venture capital institutions are to be supported in cooperating with business incubation platforms, and in providing a combination of funds, platforms, and business support for the transformation and industrialization of scientific and technological achievements of research institutions and industrialization of scientific and technological achievements of research institutions hrough a venture capital + incubation model.

2. Science and technology-type enterprises implementing the transformation and industrialization of scientific and technological achievements are to be supported in direct financing through multi-stage capital markets. Additionally, support for the reorganization and listing of these enterprises is to be strengthened, supporting their listing on the national small and medium-sized enterprises share transfer system and regional equity exchange markets.

3. The development of scientific and technological financial intermediary service organizations such as intellectual property evaluation, technology transfer, patent agency, credit rating, credit enhancement, etc., is to be supported, and various Science and Technology Financial Service Organizations are to be encouraged to use technologies such as the internet, mobile internet, big data, etc., to build investment and financing information service platforms for the transformation and industrialization of scientific and technological achievements.

4. To provide targeted lending services for scientific and technological achievement transformation projects, Science and Technology Intermediary Agents are to utilize the capital's science and technology big data open mechanism, strengthen lending matching services between financial institutions and science and technology enterprises, and promote the construction of market-oriented project screening mechanisms.

Regulation Name	"Beijing Municipal Action Plan for Promoting the Transfer and Transformation of Scientific and
(Issuing Department and	Technological Achievements" ("北京市促进科技成果转移转化行动方案")
Implementation Date)	(Beijing Municipal People's Government, November 2, 2016)

1. Market orientation is to be maintained. The decisive role of the market in the allocation of science and technology innovation resources is to be fully utilized, the dominant position of enterprises in the transfer and transformation of scientific and technological achievements is to be strengthened, and coordinated innovation among industry, academia, and research is to be promoted. The market-oriented technology innovation mechanism is to be improved, the technology market is to be actively developed, and a market environment for the application of new technologies and products (services) is to be nurtured. Following the rules of scientific research, technological innovation, and the transformation of achievements, capital, talent, and services are to play a catalytic role in the transfer and transformation of scientific and technological achievements are to be explored, institutional barriers restricting the transfer and transformation of scientific and technological achievements are to be broken through, and society's overall innovation potential and energy is to be activated.

2. Numerous group innovation spaces supporting the development of the real economy are to be constructed, a considerable number of exemplary technology transfer organizations will be established, and the transformation and application of significant scientific and technological achievements will be promoted, cultivating new forms of business that integrate technology innovation, application services innovation, and business model innovation. More than 10,000 companies are to be incubated, and the proportion of value-added from technology transactions to the region's GDP will be maintained at about 9%.

3. A unified information system for scientific and technological achievements within the city is to be constructed. A technology market information network and service platform will be established. Centered on the transfer and transformation of scientific and technological achievements through the Internet+ (Plus), a market-oriented mechanism introduction will be sought, and a cooperation system between the government and social capital is to be built. The technology market information network and service platform, which is operated according to market rules, is to be used to accelerate the construction of the Beijing technology market's monitoring and information dissemination system, realizing functions such as real-time monitoring of technology transaction information, real-time dissemination of information on potential technology transactions, and periodic online dissemination of new technologies and products (services).

4. Technology transfer service organizations are to be nurtured. The development of technology transfer service organizations conducting activities such as technology transactions, technology evaluation, technology investment and financing, and information consulting is to be actively supported, and an expert, market-oriented international technology transfer service system is to be established. Organizations such as universities and research and development organizations equipped with the necessary conditions are to be encouraged to establish expert technology transfer service organizations, and while guiding industrial needs, new service models integrating applied research and development, technology transfer, incubation, and venture capital are to be explored. Technology transfer services are to be promoted through the Internet+ (Plus) and new services actively deployed based on next-generation information technology, guiding technology transfer service organizations to upgrade from "point-to-point" services to comprehensive service models.

5. These services are to play the role of a model and leader in the transfer and transformation of domestic scientific and technological achievements. A regional cross-sectoral platform for scientific and technology conditions and achievements, and a green channel for the transfer and transformation of achievements is to be constructed around one station and one platform (Capital Science and Technology Conditions Cooperation Station and Beijing Technology Market Service Platform) Furthermore, inter-regional exchange and cooperation in technology transactions is to be promoted, along with intellectual property rights protection, venture capital, and science and technology consulting services. The construction of a national technology transfer aggregation area centered on the Zhongguancun National Independent Innovation Demonstration Zone (Zhongguancun West District), is to be accelerated, creating a cluster of numerous technology transfer service organizations, and building a national technology transfer demonstration zone.

Regulation Name	"Policies and Measures for Deepening the Reform of the Science and Technology System in the
(Issuing Department and	New Era and Accelerating the Construction of a National Science and Technology Innovation
Implementation Date)	Center" ("关于新时代深化科技体制改革加快推进全国科技创新中心建设的若干政策措施")
	(Beijing Municipal People's Government, October 16, 2019)

1. Breakthroughs in technologies that are bottlenecks for new-type research and development institutions⁸⁸, universities, research and development organizations, and advanced science and technology enterprises are to be supported, strategic collaboration and joint research will be promoted up and down the industrial chain, and efforts will be made to build new competitive advantages. The introduction of professional, market-oriented, and international third-party service organizations will be supported through government service purchases, providing professional services for attracting high-level talent, matching key scientific and technological achievements with industry projects, etc.

2. The delegation of authority for independent assessment of professional titles in universities, research and development organizations, and advanced medical and health organizations will be promoted. Career paths for technology transfer and transformation talent will be smoothed, and the professional evaluation of titles such as technology agents will be promoted. 3. The legislation of the "Beijing Municipal Regulations on Promoting the Transformation of Scientific and Technological Achievements," will be promoted. The granting of ownership or long-term usage rights of scientific and technological achievements to scientific and technological personnel will be recognized. The rights of those who have completed scientific and technological achievements to implement the transformation of these achievements themselves will be clarified. Asset management procedures related to the transformation of scientific and technological achievements in applied projects established with fiscal funds will be clarified, the methods and conditions under which leading scientific and technological achievements in applied projects established with fiscal funds will be clarified, the methods and conditions under which leading scientific and technological achievements will be clarified and a diligence and responsibility system for the transformation of scientific and technological achievements will be established.

4. The reasonable flow of science and technology-type enterprises across districts will be supported in accordance with market demand and business needs and the strategic positioning of the capital, as well as the construction of public science and technology service platforms for technology research and development, concept proofing, industrial design, testing and inspection, and large-scale prototyping, providing specialized services for small and medium-sized enterprises. The establishment of specialized incubators in the fields of life sciences, artificial intelligence, integrated circuits, 5G, etc., will be strengthened, and thorough incubation of projects will be implemented. The establishment of an incubation relay fund by the Beijing Science and Technology Innovation Fund, which specializes in investing in excellent projects that have withdrawn from incubator-specific funds, will be considered.

5. The role of government funds in attracting social capital for original innovation, achievement transformation, and investment in cutting-edge industries will be achieved, and a fund system covering seed stage investment, angel investment, venture capital, and M&A funds will be formed. The establishment of specialized insurance organizations will be considered. The improvement of the intellectual property rights insurance system will be promoted and based on the principle of government-led and market-driven, a fiscal support intellectual property rights insurance risk compensation and premium subsidy mechanism will be constructed.

⁸⁸ In Beijing, this applies to the Beijing Academy of Quantum Information Sciences, 北京脳科学 類脳研究中心, Beijing Institute of Artificial Intelligence, Beijing Institute of Life Science, etc.

Regulation Name	"Beijing Municipal Regulation on Promoting the Transformation of Scientific and Technological
(Issuing Department and	Achievements" ("北京市促进科技成果转化条例")
Implementation Date)	(Beijing Municipal People's Congress Standing Committee, November 27, 2019)

1. Activities for the transformation of scientific and technological achievements must respect scientific and technological innovation and the principles of market economy, and a sound mechanism for coordinating deliberations related to the transformation of scientific and technological achievements must be established.

2. A rights distribution mechanism for scientific and technological achievements that aims to enhance the value of knowledge will be established and improved, with the reform of rights ownership of scientific and technological achievements actively promoted. The legitimate rights and interests of all parties involved in the transformation of scientific and technological achievements will be respected, protected, and guaranteed.

3. Enterprises, research and development organizations, universities, and other organizations will be encouraged to build talent cooperation and exchange mechanisms through the two-way flow of scientific and technological personnel and project cooperation. Research and development organizations and universities are to construct industry-academia-research collaboration platforms, and projects for the transformation of scientific and technological achievements will be carried out, attracting scientific and technological personnel from enterprises in a part-time capacity.

4. Support for the construction of public research and development platforms, which provide services such as technology integration, common technology research and development, pilot-industrial tests, systematized and engineered development, and technology dissemination and demonstration for the transformation of scientific and technological achievements, will be provided. Support for the establishment of incubators, which offer services including incubation space, business coaching, research and development, and management consulting, will be provided. Certified national and municipal level incubators and university science parks will be allowed to receive tax exemptions on property, land, and income, as per the relevant national regulations.

5. Strengthening the construction of the technology transaction market in Beijing will be pursued, offering a venue for technology transactions for both parties, standardizing the disclosure of information and the process of technology transactions, and deploying comprehensive support services for technology transactions. Support for activities such as information dissemination, matching of supply and demand, quotations, bidding, auctions, and listings through the technology transaction market will be provided by organizations like enterprises, research and development organizations, universities, and industry associations. The construction of application scenarios necessary for the transformation of scientific and technologies, products, business forms, and business models formed through the transformation of scientific and technologies, products, business forms, and business models formed through the transformation of scientific and technologies achievements. Services such as data disclosure, infrastructure, technology verification environments, testing standards, and demonstration applications will be provided based on law and their implementation in Beijing facilitated.

Regulation Name	"Beijing Municipal Measures on the Accreditation and Management of Science and Technology
(Issuing Department and	Business Incubators" ("北京市科技企业孵化器认定管理办法")
Implementation Date)	(Beijing Science and Technology Commission, July 28, 2020)

1. Based on the requirements of the Ministry of Science and Technology's "Science and Technology Business Incubator Management Measures", policies will be formulated to guide the development of incubators in the city towards specialization, marketization, and internationalization, in line with the city's actual situation.

2. The Beijing Municipal Science and Technology Commission is to be fully responsible for the accreditation and management of the city's incubators.

3. When applying for incubator accreditation, the following conditions must be met:

(1) Registered within the administrative region of Beijing with independent legal personality, in addition to one year having passed since actual registration, the service field of incubation be in cutting-edge industrial sectors that Beijing is focusing on developing such as information technology, integrated circuits, medicine and health, intelligent equipment, energy conservation and environmental protection, new energy and intelligent vehicles, new materials, artificial intelligence, software and information services, scientific and technology services, etc.

(2) Capable of providing one or more of the following professional services to incubated companies: specialized platform services, supply chain services, resource matching services.

(3) The proportion of specialized service revenue to total revenue in the previous year is 30% or more, or the average growth rate of specialized service revenue in the past two years is 5% or more.

(4) Have established a system for providing training and guidance to incubated companies in fields such as technology, finance, marketing, management, administration, intellectual property rights, business, etc. Mentoring services be provided to at least 50 people annually.

(5) Have established funds for angel capital or venture capital or invested in early-stage projects with own funds. The proportion of incubated companies that received investment in the previous year is 30% or more, and among the invested companies, the proportion of those that received investment from the incubator is 10% or more.

(6) Possess a professional management team.

(7) More than 20 incubated companies are registered within the city's administrative region, and the average growth rate of the incubated companies' business income in the past two years is 10% or more. The proportion of incubated companies that have applied for intellectual property rights such as patents, software copyrights, exclusive rights for integrated circuit layout designs, nationally new drugs, new plant varieties, etc., is 50% or more, or the proportion of incubated companies that have valid intellectual property rights is 30% or more.

4. Attracts social investment. Supports the establishment of incubation relay funds, guiding social capital to show more interest in investing in early-stage projects.

5. Deploys regional layouts. Strengthens the deployment of specialized incubators in industrial sectors such as medicine and health, artificial intelligence, blockchain, the Internet of Things, 5G, etc.

Regulation Name	"The 14th Five-Year Plan for the Development and Construction of the Zhongguancun Fengtai
(Issuing Department and	Science and Technology Park" (""十四五"时期中关村科技园区丰台园发展建设规划")
Implementation Date)	(Beijing Fengtai District People's Government, February 21, 2022)

1. Fengtai Park will focus on upgrading the level of open innovation in fields such as rail transit, aerospace, and scientific and technology services, raise the international development standard in fields such as scientific and technology finance, research and development, incubation, and science and technology intermediaries, actively participate in the pioneering reforms conducted in Zhongguancun, and aim to become a frontline base for the international science and technology innovation center.

2. The science and technology service industry will be developed in a leapfrog manner. The development of research and development services, scientific and technology financial services, and incubation services are to be strengthened further. Related industry alliances will be encouraged to participate in joint innovation, and a large number of testing and inspection service organizations with reliability and brand effects in comprehensive testing fields are to be attracted to the park. As an innovative model case for the system of intellectual property rights protection and operation, based on the National Intellectual Property Administration Patent Center, the aim will be to create a clustered series of intellectual property rights service organizations. Insurance institutions and loan guarantee institutions will be encouraged to establish specialized operational entities focused on science and technology finance services, including science and technology insurance and science and technology loan guarantees. The early and experimental implementation of policies related to the establishment of Zhongguancun venture capital clusters are to be strived for, and domestic and foreign famous PE, VC, angel investors, are to be actively attracted. Existing incubators, etc., will be guided to pass national and Beijing city certification, a large number of internationally and domestically famous incubators are to be attracted to the park, and leading enterprises in target industries are to be encouraged to establish industry-specific incubators there, with the development of entrepreneurship bases supported based on diverse funding support methods.

3. A leading role is to be played in government-led funds. The expansion of the Beijing Natural Science Fund-Fengtai Rail Transit Frontier Research Joint Fund is to be supported, and the research and development capability of rail transit frontiers is to be strengthened. Based on the Fengtai District Government Guidance Fund, capital participation-type sub-funds are to be established, and the integration of industry and capital is to be promoted. The industrial park platform's leadership functions are to be strengthened. The transformation and upgrade of industrial park platform companies are to be promoted, and three major business sectors will be deployed: asset development and operation, scientific and technology finance, industrial services. Centered on existing excellent assets, new fundraising methods such as ABS (Asset-Backed Securities), CMBS (Commercial Mortgage-Backed Securities), REITs (Real Estate Investment Trusts) are to be explored, fundraising channels further expanded, and inspection, testing, and certification services are to be vigorously deployed. The construction of the China Academy of Railway Sciences China Railway Product Certification Center is to be actively promoted, reliable domestic and foreign inspection and testing companies with brand effects are to be actively attracted, and a public technology platform for inspection and testing within the industrial park is to be built.

4. Focus is to be placed on the construction of industry-led incubators. A large number of famous incubators are to be attracted. Links with external high-quality resources are to be built targeting domestically and internationally famous incubators, and a large number of high-quality innovation and entrepreneurship-related companies are to be introduced to the area.

(2) Shanghai

Regulation Name	"Shanghai Municipal Regulations on Science and Technology Progress" ("上海市科学技术进
(Issuing Department and	步条例")
Implementation Date)	(Shanghai Municipal People's Congress, September 17, 2010)

Main Content

1. The city's scientific and technological activities should aim for economic construction and social development, promoting the transformation of scientific and technological achievements into practical productive forces. These regulations apply to scientific research, technological development, the expansion and application of scientific and technological achievements, the dissemination of science and technology and related services, as well as administrative management activities in the city.

2. The municipal people's government is to build and improve public service platforms for research and development, provide services such as consulting on scientific and technological resource information and the dissemination of scientific and technological services to research institutions, higher education institutions, and enterprises, promote the integration and effective use of scientific and technological resources, and support scientific and technological innovation activities. The managing departments of scientific and technological resources must open these resources to society, and reach an agreement with users on the rights and obligations concerning the content of services, fees, ownership of intellectual property rights, confidentiality, compensation for damages, liability for breach of contract, dispute resolution, etc.

3. The municipal, district, and county people's governments must cultivate and develop the technology market, encouraging social forces and scientific and technological personnel to establish various STIAs that conduct activities such as technology assessment, technology management intermediation, and technology consulting. The actions of intermediary service institutions must be standardized, industry self-discipline must be strengthened, and the specialization level and service capacity of intermediary service organizations must be improved.

4. Those engaged in technology development, technology transfer, technology consulting, and technology service activities can receive preferential tax measures based on national regulations.

Regulation Name	"Opinions on Further Deepening the Reform of the Science and Technology System and
(Issuing Department and	Enhancing the Source Capacity of the Science and Technology Innovation Center" ("关于进一
Implementation Date)	步深化科技体制机制改革增强科技创新中心策源能力的意见")
	(Shanghai Municipal People's Government, March 21, 2019)

1. By 2035, Shanghai will build a vibrant regional innovation system, with a large number of world-class innovation platforms and innovation enterprises emerging, becoming an important hub in the global innovation network, and significantly strengthening the core functions of the science and technology innovation center.

2. New-type research and development institutions⁸⁹, are to be actively developed, forming a development pattern that complements the advantages of various research and development institutions and builds win-win relationships of cooperation. Based on the principle of combining government guidance with market-oriented operation, support for innovation in the industrial chain and the research and development of major products are to be targeted, and the promotion of the construction of platforms with research and development and transformation functions is to be encouraged.

3. The construction of technology transfer systems in universities and research and development institutions is to be strengthened, with the introduction of specialized institutions, specialized teams, and working funds. More than 10% of the net revenue generated by the transformation of scientific and technological achievements is to be used for organizational capacity building and personnel incentives after the transfer and transformation. Professional positions for technology transfer are to be established, providing a promotion path for technology transfer personnel. The performance of scientific researchers in the transformation of scientific and technological achievements is to be considered as an important criterion for their title (position) evaluation and job appointment. Performance in the transformation of scientific and technological achievements will be considered as an important basis for the evaluation and assessment of "Double First-Class" universities, high-level regional universities, research and development institutions, along with reviews and evaluations of applied science research projects, and subsequent support.

4. The construction of a Science and Technology Innovation Data Resource Center is to be undertaken, establishing a regional comprehensive data center that covers key areas of scientific data, major scientific facilities, innovation bases, equipment, personnel, organizations, and other science and technology innovation resources, aiming to build an internationally influential scientific data center (bank)

Regulation Name	"Several Regulations (Trial) on Promoting the Innovation Development of New-Type Research
(Issuing Department and	and Development Institutions" ("关于促进新型研发机构创新发展的若干规定")
Implementation Date)	(Shanghai Science and Technology Commission, April 20, 2019)

Main Content

1. New-type research and development institutions are different from traditional research and development institutions. They are equipped with a flexible and open institutional mechanism for the transformation of scientific and technological achievements and incubation services. Characterized by the concentration of resources and specialized scientific and technological services, they incubate and cultivate science and technology-type enterprises and accelerate the transformation of scientific and technological achievements into real productive forces, promoting innovation and entrepreneurship.

2. Departments of science and technology, development and reform, industry, education, civil affairs, finance, etc., of the city cooperate to coordinate and promote the construction and development of the new-type research and development institutions, adjusting their layouts, systematically organizing their accreditation, and implementing related policies and measures, while entrusting their evaluation to third parties.

⁸⁹ During the 13th Five-Year Plan period, Shanghai maintained and constructed dozens of new-type research and development institutions. These included 10 institutions focused on frontier fields such as artificial intelligence, quantum science, and brain science.

Regulation Name	"Regulations on Promoting the Construction of a Science and Technology Innovation Center in
(Issuing Department and	Shanghai" ("上海市推进科技创新中心建设条例")
Implementation Date)	(Shanghai Municipal People's Congress, January 20, 2020)

1. An orientation adhering to needs and industrialization is to be maintained, with the innovation chain arranged around the industrial chain. The coordination and organization of the city's scientific research, technological innovation, transformation of sciencific and technological achievements, and dissemination of science and technology are to be undertaken by the city's science and technology department, which bears the role of constructing the city's innovation system and promoting the reform of the science and technology system and mechanism.

2. The city's support for the development of new-type research and development institutions equipped with diverse investment entities, market-oriented operation mechanisms, and modern management mechanisms is to be ensured. Innovation in methods of financial support and management for new-type research and development institutions that meet the requirements is needed by relevant departments of the municipal and district people's governments.

3. The municipal and district people's governments are to actively cultivate Science and Technology Intermediary Agents, guiding them to provide services to various innovation entities through means such as science and technology innovation vouchers Various Science and Technology Intermediary Agents are to be encouraged to innovate service models and expand service chains, providing specialized services such as research and development, technology transfer, testing and inspection, certification and accreditation, intellectual property rights, and science and technology consulting for science and technology innovation and industrial development.

4. The city will strengthen the construction of specialized service organizations for the transformation of scientific and technological achievements and establish special funds for the transformation of scientific and technological achievements, with the aim of improving the efficiency of transformation by establishing a sound mechanism for the supervision of intangible assets of state-owned technology in accordance with the discipline of the transformation. When scientific research organizations determine the price of scientific and technological achievements through methods such as agreed pricing, listing and trading on the technology exchange market, and auctions, they can be exempted from asset valuations and declarations based on law. Upon agreement of the price, the name of the scientific and technological achievement and the proposed transaction price must be published.

5. Insurance institutions will be encouraged to provide insurance and protection for companies innovating in all aspects of product research and development, production, sales, data security, and intellectual property protection. Funding assistance for the construction of scientific and technological infrastructure and corporate scientific and technological innovation activities is to be provided through market-based investments in accordance with the law. All types of domestic and foreign capital and investment institutions are to establish professional investment institutions such as venture capital funds, stock investment funds, M&A investment funds, industrial investment funds, and mother funds, and to engage in venture capital investments

Regulation Name	"Detailed Rules for the Management of Shanghai Municipal Technical Exchange" ("上海市技
(Issuing Department and	术交易场所管理细则")
Implementation Date)	(Shanghai Science and Technology Commission, April 18, 2020)

1. The technical transactions referred to in these detailed rules include the following transaction activities: Rights transactions specialized in technology, where the subject of the transaction includes technological achievements and technical services, and the transaction methods include technology development, technology transfer, technical consulting, technical services, etc. The technological achievements referred to in these detailed rules are defined as results with practical value produced through scientific research and technological development. Technical services are defined as acts where one party uses technical knowledge to solve specific technical problems for another party.

2. The technology exchange must operate strictly in accordance with the law, the approved scope of business and varieties of business, and the transaction system by the market supervision and management department and the industry management department and must formulate transaction rules in accordance with relevant policies and regulations. A risk management system and system adapted to the nature, scale, and complexity of the business engaged in during the transaction must be established, and based on law, a risk management system, information disclosure system, fair trading system, technical service organization management system, and dispute resolution system must be set up to create a fair and equal market environment for market participants and ensure the normal operation of the city's technology transaction market.

3. Technical transactions can be carried out through negotiated transfer, auction, bidding, competitive bidding, and other means in accordance with national policies and regulations. The technology exchange must regularly submit monthly reports, quarterly reports, and annual reports to the Shanghai Science and Technology Commission. As required by regulatory activities, the Shanghai Science and Technology Commission can request the technology exchange to provide related market information, business documents, and other related data and information.

Regulation Name	"Shanghai Municipal Science and Technology Innovation and Entrepreneurship Carrier
(Issuing Department and	Management Measures (Trial)" ("上海市科技创新创业载体管理办法(试行)")
Implementation Date)	(Shanghai Science and Technology Commission, October 26, 2020)

1. The science and technology innovation and entrepreneurship carriers (organizations responsible for innovation and entrepreneurship) referred to in these measures are science and technology entrepreneurship service organizations that aim to promote the transformation of scientific and technological achievements and nurture science and technology-type enterprises and entrepreneurial spirit, by providing low-cost, convenient, all-factor open-platforms, and professional services to meet the public's needs for innovation and entrepreneurship. This definition mainly includes incubators, group innovation spaces, and university science and technology parks. The Shanghai Science and Technology Commission is responsible for the dynamic management and business guidance of carriers within the city.

2. The incubator standards in the city's carrier cultivation system are as follows: (1) Registered as an independent legal entity in the city, has been in actual operation for more than one year, (2) The incubation site is centralized, with more than 3000 square meters of autonomously managed incubation space, of which the area used by incubated companies (including the area for public services) accounts for at least 75%, (3) The incubator provides its own seed capital or joint incubation funds of more than 3 million yuan, and has more than three cases of fund utilization, (4) Expert incubation service personnel (full-time staff of the innovation and entrepreneurship carrier with experience in entrepreneurship, investment and financing, management, etc.) account for at least 80% of the institution's total personnel, with at least one professional incubation service person and entrepreneurship mentor for every ten incubated companies, (5) Have incubated at least 15 companies, 75% of which are in the same specialty field as the incubator, (6) Among the incubated companies, the proportion of companies that have applied for patents is at least 50%, or the proportion of companies with valid intellectual property rights is at least 30%, (7) The incubation service function is relatively complete, capable of providing incubation services such as space, shared facilities, technical services, consulting services, investment and financing, entrepreneurship guidance, resource matching, and market development to resident companies.

3. Carriers included in the city's cultivation system that meet the requirements can receive related tax incentives according to national regulations. If relevant national regulations are adjusted, these adjusted regulations will apply. Carriers included in the city's cultivation system and evaluated as C grade (pass) or above annually can apply for priority listing on the service provider list according to the "Shanghai Municipal Science and Technology Innovation Voucher Management Measures (Trial)" (related regulations). Incubators and group innovation spaces included in the city's cultivation system, who are evaluated as B grade (excellent) or above annually, can receive financial subsidies of up to 50% of the annual investment amount for improving specialized incubation capabilities, expanding their brand and service spill-over, and international incubation exchange and cooperation. The use of funds must comply with relevant national and municipal regulations. University science and technology parks, incubators, and group innovation spaces evaluated as A grade (excellent) can receive subsidies of up to 1 million yuan, 600 thousand yuan, and 400 thousand yuan, respectively. For B grade (excellent), up to 50% of the A grade subsidies are provided.

4. Major companies, universities, research and development institutions, investment institutions, etc., will be encouraged to build various forms of innovative carriers such as accelerators, concept proof centers, innovation experiment platforms, etc. Through institutional mechanism and incubation model innovation, the opening and sharing of innovation and entrepreneurship resources are to be promoted, with a focus on clear industrial segments and the introduction of expert talent. Active engagement in vertical incubation and deep incubation is to be performed, and service efficiency and capability are to be enhanced based on new technologies such as the internet, big data, and artificial intelligence.

Regulation Name (Issuing Department and Implementation Date)	"Shanghai Municipal Action Plan for Promoting the Transfer and Transformation of Scientific and Technological Achievements (2021-2023)" ("上海市促进科技成果转移转化行动方案 (2021-2023年)") ("Shanghai Municipal People's Government, May 28, 2021")
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1. The decisive role of the market in resource allocation is to be fully leveraged, the flow of factors is to be smoothed, and the factor allocation capability of the technology market is to be increased, to achieve the greatest benefits and most optimal efficiency. The government will focus on strategies, plans, policies, and services to create a favorable environment for the prosperity of the technology market.

2. Rationalization of the distribution system for revenue from the transformation of results is to be pursued, actively and steadily promoting the trial of employee stock ownership plans and various stock incentive systems in mixed-ownership enterprises and promoting the ownership reform of scientific and technological achievements in state-owned enterprises, as well as improving the implementation regulations for market-oriented operations of state-owned venture enterprises.

3. A full-cycle management system for scientific and technological achievements is to be built, and the mechanism that guarantees it is to be improved. Before the clear transformation of scientific and technological achievements, the exploration of related mechanisms for managing them as scientific and technological resources is to be promoted, and fundraising for the establishment of concept proofing funds is to be encouraged.

4. The construction of technology transfer operation organizations is to be strengthened, and the effectiveness of transformation is to be enhanced. Special funds can be implemented in accordance with the regulations of net profit from the transformation of results, organizations are encouraged to procure the services of third-party professional institutions, and organizations with these conditions are to be encouraged to explore market-oriented operation mechanisms.

5. The support capacity of transformation carriers is to be enhanced, providing services to the entire innovation chain. The acceleration of the construction of the Big Zero Bay 90 innovation and entrepreneurship cluster, the building of exhibition and transformation centers for the achievements of academicians and experts, the promotion of university science and technology parks as the "first base" for the transformation of university achievements, along as "core incubation parks" for regional innovation and entrepreneurship, and the "Zhangjiang R&D+Made in Shanghai" model for the transformation and industrialization of achievements in the Shanghai Zhangjiang High-Tech Industrial Development Zone is to be explored.

6. Specialized technology transfer organizations are to be actively developed, and the service market is to be expanded. The construction of the technology transfer service system is to be deepened, the establishment of a technology transfer organization bank, and support for the implementation of specialized services such as technology exploration, scientific and technological evaluation, concept proofing, technology investment and financing, as well as technology transfer services in the field of industrial technology and cross-border technology transfer services are to be provided. Group innovation spaces, investment institutions, and intellectual property service agencies are to be encouraged to expand their technology transfer functions. City-level technology transfer demonstration institutions are to be cultivated, the outcome-oriented evaluation mechanism is to be improved, and grants according to performance are to be provided.

7. The functions of related exchanges are to be integrated and the alignment of factor resources is to be promoted. The Shanghai Technology Exchange is to be supported in establishing a national intellectual property and scientific and technology property right exchange organization and in expanding operational services such as technology transfer and licensing to a national scale The layout of the international technology transfer network is to be improved, and the effectiveness of resource flow is to be enhanced.

⁹⁰ 大零号湾: Since 2018, the Minhang District, the Municipal Science and Technology Commission, and Shanghai Jiao Tong University have jointly promoted the construction of the "Southern Shanghai Science and Innovation Center 大零号湾 Core Functional Area" (abbreviated as 大零号湾), leveraging the strengths of the district and the university to jointly promote the transformation of global scientific and technological achievements and the construction of a natural science and technology innovation zone.

Regulation Name	"Shanghai Municipal Expert Technical Service Platform Construction and Management
(Issuing Department and	Measures" ("上海市专业技术服务平台建设与管理办法")
Implementation Date)	(Shanghai Science and Technology Commission, March 23, 2022)

The service platform is an important part of Shanghai's scientific and technological innovation service system, integrating various scientific and technological resources to provide public, open, and comprehensive expert technical services to society, leading the industry with a model that is based on the market but works for the common good. The Shanghai Science and Technology Commission is the comprehensive management department for the service platform.
 The main tasks of the service platform are as follows. (1) Provide various external services such as research and development design, testing and verification, technical consulting, inspection and testing, technical evaluation, pilot incubation, technology dissemination, etc., (2) Provide specialized technical and personnel training services to companies in the same industry or field, (3) Engage in various forms of scientific and technological cooperation and exchange activities with domestic and foreign companies, universities, and research and development institutions in the same industry or field.
 The individual directly responsible for the service platform will be appointed by the supporting organization. This individual must be a technical expert in the field, with strong organizational management and coordination capabilities, who proposes development plans for the service platform that meet the technical needs of the industry field and key technology development and is responsible for ensuring the operating conditions of the service platform and specific implementation work.

Regulation Name (Issuing Department and Implementation Date)"Operational Rules for Promoting the Transformation of Scientific and Technological Achievements of Medical and Health Institutions in Shanghai (Trial)" ("上海市の医療衛生機 の科学技術成果の転化を促進する運営細則(試行)」(「上海市促进医疗卫生机构科技成果 化操作细则(试行)") (Shanghai Science and Technology Commission, November 17, 2022)	Regulation Name (Issuing Department and Implementation Date)
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1. The purpose of these operational rules is to guide the city's medical industry to efficiently conduct the transformation of scientific and technological achievements in line with the rules, strengthen the close integration and optimal allocation of innovation resources such as technology, capital, talents, and services in the medical and health field, and promote the transformation of scientific and technological achievements. The transformation of scientific and technological achievements. The transformation of scientific and technological achievements. The transformation of scientific and technological achievements, new technologies for prevention, clinical diagnosis, treatment, special medical food preparations, digital diagnosis and treatment, etc., researched and developed, clinically tested, transformed, transformed, disseminated, and applied by medical and health institutions and their scientific and technological personnel.

2. Medical and health institutions must set up a special technology transfer department or position responsible for process management, intellectual property management, contract management, and legal affairs for the transformation of scientific and technological achievements. Furthermore, professional technology transfer service organizations are to be developed, and medical and health institutions equipped with the right conditions can either independently or jointly with enterprises establish technology transfer service institutions in a market-oriented manner. Medical and health institutions are to be encouraged to entrust third-party service organizations to perform technology transfer services such as evaluation of scientific and technological achievements, operation of intellectual property rights, compliance and risk management, technology investment and financing, matching of demand and supply, negotiation of transactions, project incubation, etc.

3. Medical and health institutions can independently decide whether to conduct asset appraisal when transferring scientific and technological achievements to others, licensing them, or converting scientific and technological achievements into shares or investment ratios. Medical and health institutions are to be encouraged to entrust third-party institutions to evaluate scientific and technological achievements in terms of market analysis, technology level, legal risk, medical evaluation, etc., to determine negotiation prices or preparation prices for listing. The recipients of achievements are to be encouraged to conduct or entrust third-party service institutions to perform industrialization evaluations of market prospects, market risks, and investment returns during the transformation stage of scientific and technological achievements.

4. Medical and health institutions can draw more than 10% of the net income from the transfer or licensing of scientific and technological achievements to ensure the operation of the technology transfer department and promote professional development, of which more than 3% can be used for rewards to dedicated staff of internal transformation services and talent development.

5. An intellectual property rights catalog mechanism is to be built and improved, awakening "sleeping patents." For scientific and technological achievements with impending intellectual property protection deadlines, encourage specialized service institutions to explore the value of these achievements and facilitate their transformation through methods such as intellectual property trusts and intellectual property value assessments. For achievements that do not hold value for transformation, cease subsequent research and development investments based on market-oriented evaluations in accordance with the law.

6. Link technology, capital, and talent, strengthen collaboration among various innovation subjects such as medical and health institutions, universities, research and development institutions, enterprises, etc., build institutional mechanisms and models for joint innovation, and promote the close integration of industry, academia, research, and medicine. Medical institutions are to be encouraged to have entrepreneurs or investors with experience in entrepreneurship, innovation, or investment, scientific and technological personnel, and other qualified personnel engage in the transformation of scientific and technological achievements on a part-time basis and receive appropriate compensation. Medical and health institutions equipped with conditions can independently establish or participate in establishing carriers such as clinical research centers, incubators, group innovation spaces, technology achievement transformation platforms, etc., and execute the transformation of scientific and technological achievements based on these carriers. Mobilize medical and health science and technology personnel, senior experts, and industry specialists to provide technical consulting, technical services, scientific research, and dissemination of results at the grassroots level, addressing the true needs of the medical health industry and the health care field through technological innovation.

(3) Shenzhen

"Certain Measures for Deepening the Reform of the Science and Technology System and
Improving Scientific and Technological Innovation Capability" ("关于深化科技体制改革提升
科技创新能力的若干措施")
(Shenzhen Municipal People's Government, November 2, 2012)

Main Content

1. An investment mechanism that adjusts competitive funds and stable support funds is to be established, and the investment structure for basic research, applied research, experimental development, and the transformation of achievements is to be optimized.

2. Financial assistance is to be expanded to incubation carriers such as "entrepreneurial nurseries", incubators, accelerators, etc., and new collaborative development models between venture capital and incubation carriers are to be considered, with participation in the construction and operation of incubation carriers through support from society.

3. Technology transfer organizations in Shenzhen promoting the transformation of scientific and technological achievements can receive up to 1 million yuan annually from the city's scientific and technological research and development funds according to their performance in promoting the transformation of scientific and technological achievements and implementation of technology transfers.

4. Foreign institutions that are independent corporations in Shenzhen are to be supported to set up research and development institutions or technology transfer organizations aligned with the development direction of strategic emerging industries. These institutions can receive up to 10 million yuan in research and development grants from the city's scientific and technological research and development fund. Local enterprises are to be supported to establish research and development institutions or technology transfer organizations abroad, either independently or jointly with universities and research and development institutions, or merge with excellent enterprises.

5. The city's intellectual property rights department should establish a mechanism for the transformation transactions of intellectual property rights, provide emergency support for foreign intellectual property rights, build a healthy intellectual property rights operation platform, and promote the establishment of a PCT (Patent Cooperation Treaty) international patent acceptance and examination institution in Shenzhen.

6. Angel funds established with capital participation from the city government's venture capital guidance fund, mainly investing in the early stages of Shenzhen's strategic emerging industries, can transfer 50% of the net profit at the angel fund's exit to other initiators after confirmation by relevant authorities. Furthermore, it is possible to grant a one-time subsidy from the city's scientific and technological research and development funds to invested companies, 2% of the actual cash investment received, up to 500,000 yuan. The establishment and investment in science and technological rapital institutions by private capital is to be supported, participation in the transformation of scientific and technological achievements encouraged, and the sound development of the science and technology venture capital industry promoted.

Regulation Name	"Measures for Promoting the Development of the High-Tech Service Industry" ("关于促进高
(Issuing Department and	技术服务业发展的若干措施")
Implementation Date)	(Shenzhen Municipal People's Government, November 2, 2012)

1. Based on the principles of government guidance, social participation, and market orientation, this initiative aims to explore market needs, expand the service sector, cultivate numerous high-tech service institutions with innovative vitality, and develop research and development, design services, intellectual property services, scientific and technological achievement transformation services, and inspection and testing services.

2. Various professional public technology service platforms will be constructed. The construction of urgently needed specialized technology service platforms for industrial development is to be planned in a unified manner. Resources from existing public technology service platforms will be integrated, promoting resource sharing and utilization. The National High-Tech Service Public Technology Platform will be encouraged to construct branches in Shenzhen.

3. Initiatives for cultivating and attracting specialized service institutions will be accelerated. The construction of hightech service institutions will be supported, and domestic and foreign companies, universities, and research and development institutions will be encouraged to establish high-tech service centers. Third-party service institutions that provide social investment and specialized services will be cultivated and encouraged to establish themselves in Shenzhen.

Regulation Name	"Shenzhen Special Economic Zone Science and Technology Innovation Promotion Regulations"
(Issuing Department and	("深圳经济特区科技创新促进条例")
Implementation Date)	(Shenzhen Municipal People's Congress, January 9, 2014)

Main Content

1. Municipal and district governments should seek to construct a new type of public service system adapted to the needs of independent innovation, establishing public service institutions for strategic research, intellectual property, technology transfer, technology property rights trading, information provision, etc. Related industry associations and intermediary organizations are to be encouraged to carry out consulting, evaluation, intermediation, and brokerage services for scientific and technological innovation.

2. Enterprises, universities, and research and development institutions are to be encouraged to collaborate and cooperate in Shenzhen. Special funds for science and technology promotion be used to provide additional support. Specifically, this applies to city enterprises conducting commissioned research, joint development, and property rights sharing with universities and statutory institutions in the Hong Kong Special Administrative Region.

(Issuing Department and and Technological Achievements" ("深圳市促进科技成果转移转化实施方案")		
	suing Department and ar	rtment and and Technological Achievements" ("深圳市促进科技成果转移转化实施方案")
Implementation Date) (Shenzhen Municipal People's Government, October 5, 2016)	plementation Date) (S	(Shenzhen Municipal People's Government, October 5, 2016)

1. The widespread application and transformation of industrial core technologies and key technologies are to be promoted. The system for transferring and transforming scientific research outcomes is to be reformed, improving the management system related to the use, disposal, and revenue of scientific and technological achievements. The market-oriented technology transaction service system is to be improved, and diverse investment routes established for the transfer and transformation of scientific and technology transfer organizations are to be established in the city, and 1 to 2 national scientific and technological achievement transfer and transformation demonstration zones are to be built in qualified districts (new districts) and high-tech parks, along with several technology transfer personnel training bases, with the aim of training 1,000 experts in technology transfer and striving to reach a technology contract transaction volume of 120 billion yuan in the city.

2. A shared resource platform for scientific and technological achievement information is to be constructed. Based on the Southern National Technology Transfer Center, a regional information platform for scientific and technological achievements is to be built, with specifications for the collection, processing, and services related to scientific and technological achievement information to be formulated. Scientific and technological achievements are to be transferred using technology standard pilot projects, supporting the transformation of technologies with mature, outstanding economic and social benefits into technical standards as part of the "Shenzhen Standard." Public information platforms for the city's scientific and technological achievements, scientific and technological reports, scientific and technological literature, intellectual property rights, standards, etc., are to be built.

3. Advanced transformation bases for which scientific and technological achievement packages apply are to be constructed. Companies in strategic emerging industries such as the Internet, biotechnology, new energy, next-generation information technology, new materials, cultural creation, energy conservation and environmental protection, as well as future industry fields such as life and health, aerospace, robotics, wearable devices, intelligent equipment, etc., are to be encouraged to transform and put to practical use a large number of national scientific and technological package technologies. The application and transformation of a large number of national scientific and technological achievement technologies is to be encouraged. The use of next-generation information technologies such as cloud computing and big data is to be promoted, actively providing value-added services for scientific and technological achievement information of scientific and technological achievement information and application of scientific and technological achievement packages.

4. Industry-university-research integrated research and development is to be supported. Based around upgrading and converting the city's industry, focus is to be placed on strategic emerging industries, future industries, and key areas of the modern service industry to construct various styles of industrial technology alliances.

5. International scientific and technological achievement industrial bases are to be built. The development of carriers related to the industrialization of scientific and technological achievements is to be supported, elevating and integrating experimental carriers, further maturing domestic and foreign advanced technology projects, and accelerating the industrialization of Shenzhen.

6. Regional technology transaction platforms are to be built and technology transaction indices are to be published. Various service institutions providing specialized services such as financing, mergers and acquisitions, public offerings, bidding and auctions, consulting, etc., are to be supported.

7. Specialized institutions for the transfer and transformation of scientific and technological achievements are to be cultivated. An integrated network of services for enterprises is to be built Technology transfer organizations with needed conditions are to be supported in establishing investment funds in cooperation with angel investors and venture capital, expanding investment and financing services for projects transforming scientific and technological achievements. The success rate of the transfer and transformation of scientific and technological achievements is to be improved. The establishment of standards and norms for technology transfer services is to be considered, an evaluation and credit mechanism for technology transfer services is to be cultivated.
8. A southern intellectual property operation center is to be established, promoting the marketization, increase in scale,

specialization, internationalization, and branding of intellectual property services

Regulation Name	"Shenzhen Special Economic Zone Technology Transfer Regulations" ("深圳经济特区技术转
(Issuing Department and	移条例")
Implementation Date)	(Shenzhen Municipal People's Congress, October 31, 2019)

1. This regulation defines technology transfer as the transfer, transplantation, introduction, operation, exchange, and dissemination of scientific and technological achievements, information, and capabilities (hereinafter referred to as technological achievements) for the manufacturing of a product, application to a process, or provision of a service. It is the transfer of systematic knowledge from the technology supplier to the technology demand side.

2. An international development strategy for technology transfer will be implemented, and international and overseas regional technology transfer, exchange, and cooperation must be encouraged in accordance with the law.

3. The technology transfer organizations established by the municipal people's government, under the guidance of the city's science and technology innovation department, will perform the following duties: (1) Implement technology transferrelated planning and plans, (2) Construct, operate, and manage public service platforms for technology transfer, (3) Provide consulting on the establishment and operation of technology transfer organizations, (4) Promote technology transfer exchanges and cooperation, (5) Register technology contracts and analyze technology market statistics, (6) Provide other public services related to technology transfer.

4. The municipal people's government shall construct and improve a multi-level risk guarantee mechanism for technology achievement secured financing, encouraging financial guarantee institutions to provide guarantee services for technology achievement collateral financing for small and medium-sized enterprises, and guiding enterprises to conduct business in peer guarantees. The reinsurance institution established by the municipal people's government may instruct guarantee institutions to provide guarantees for technology transfer activities.

5. The city's science and technology innovation department must strengthen the construction of public service platforms and their carriers for technology transfer, provide public services such as correcting pilot testing, technology integration and operation, technology transactions and investment financing, information resources and cooperation channels for technology transfer, and improve technology transfer capabilities.

6. The establishment of various technology transfer organizations is to be encouraged to provide the following services:
(1) Collection, selection, analysis, and processing of technology information, (2) Technology consulting and evaluation,
(3) Integration and operation of technology, (4) Intermediate and industrial tests, etc., (5) Technology transfer and representation, (6) Technology investment and financing, (7) Training of personnel in the field of technology transfer.

7. The introduction and development of new type financial institutions providing lending services for the industrialization of technological achievements is to be encouraged.

Regulation Name	"Shenzhen Science and Technology Innovation '4th Five-Year' Plan" ("深圳市科技创新
(Issuing Department and	"十四五"规划")
Implementation Date)	(Shenzhen Science, Technology and Innovation Commission, January 12, 2022)

1. An incubation and cultivation system for the entire industrial chain is to be constructed. The construction and operation mechanism of demonstration centers is to be improved, deploying numerous small and medium-sized pilot transformation bases centered on enterprises, providing public services such as small-scale demonstration tests, measurement and testing, inspection and measurement, and certification. The deployment and construction of group innovation spaces, incubators, accelerators, and science and technology parks are to be strengthened.

2. A technology transfer service system is to be established. Universities and research and development institutions are encouraged to establish technology transfer organizations and strengthen the training of technology managers. A public service platform system for technology transfer based on the Southern National Technology Transfer Center and the Southern Venture Capital Network is to be built.

3. A mechanism that links the city's science and technology research and development funds with government-led funds and angel investment guidance funds is to be created. The angel investment guidance fund is encouraged to provide financing services to science and technology projects, encouraging more funds to engage in early-stage and small-scale investments in science and technology.

4. The construction of national intellectual property rights and scientific and technological achievements property rights transaction centers is to be promoted. Market-based pricing and transaction mechanisms for intellectual property rights and the property rights of scientific and technological achievements are to be considered and improved, building a comprehensive national service platform that integrates the technology market with the capital market.

5. A financial support system for science and technology innovation across the entire industrial chain is to be constructed. The establishment of small and medium-sized experimental transformation investment funds and piloting a loan risk compensation system related to the transformation of achievements are to be encouraged. Policies such as follow-on investment and financial risk compensation by guidance funds are to be improved. The Shenzhen Stock Exchange is to be encouraged to provide financial services such as securities, funds, and bond products.

6. The science and technology financial service system is to be improved. A science and technology financial service platform based on the Southern Venture Capital Network, Venture Capital Plaza, and Science and Technology Finance Alliance is to be built, enhancing services such as information disclosure, project matching, enterprise evaluation, etc., and constructing a platform that matches science and technology-type companies with the capital market.

Regulation Name	"Measures on the Management of Science and Technology Business Incubators and Group
(Issuing Department and	Innovation Spaces in Shenzhen" ("深圳市科技企业孵化器和众创空间管理办法")
Implementation Date)	(Shenzhen Science, Technology and Innovation Commission, February 15, 2022)

1. This regulation defines incubators as innovation and entrepreneurship support platforms that focus on emerging science and technology enterprises, providing entrepreneurial space, shared facilities, and specialized services to reduce startup costs, improve startup survival rates, and promote enterprise growth. The city's science and technology administrative department arranges funding from the city's science and technology research and development funds to support the construction of incubators and group innovation spaces by leading companies, universities, research and development institutions, venture capital institutions, and social organizations, offering post-subsidies or incentive subsidies for leading and exemplary incubators and group innovation spaces with clear development models that meet qualifying conditions.

2. For city-level incubator accreditation, the following conditions must be met: (1) The operator of the incubator must be a company or business organization legally registered in Shenzhen or the Shenzhen-Shantou Cooperation Zone with corporate status, (2) The incubator has been operational for at least 2 years, has a clear development direction, a sound operational management system, and an incubation service mechanism, (3) The incubation site area must be at least 3,000 square meters, with at least 75% of the area used by incubated companies (including public service areas). It must host over 20 incubated companies, with an average of at least 3 incubated companies per 1,000 square meters. At least 50% of the total number of incubation companies must have applied for patents, or at least 30% must have valid intellectual property rights. (4) The incubator must have at least 8 graduated companies, possess an expert team for incubation services, with at least 5 members being experts. It must be capable of providing comprehensive services such as technology transfer, science and technology finance, entrepreneurship guidance. It must also have contracts with at least 6 science and technology intermediary organizations and 3 entrepreneurship mentors. The incubator must have its own seed capital or co-incubation funds of at least 3 million yuan, with at least 2 incubated companies receiving investment and financing.

3. The city's science and technology administrative department will provide post-subsidies to certified incubators and group innovation spaces, with a maximum subsidy amount of 3 million yuan for incubators and 2 million yuan for group innovation spaces, not exceeding 50% of the operational costs invested by the operating organization in the past 2 years.

4. Incubators and group innovation spaces should enhance their service capabilities, and utilize new technologies such as the internet, big data, artificial intelligence, etc., to improve service efficiency and quality. Qualified incubators and group innovation spaces should be encouraged to establish a sound service mechanism characterized by "Group Innovation to Incubation to Acceleration," providing entrepreneurship services throughout the entire cycle, and fostering a science and technology innovation and entrepreneurship ecology.

(4) Tianjin

Regulation Name	"Tianjin City Regulations on Promoting Technology Transactions" ("天津市促进技术交易条
(Issuing Department and	例")
Implementation Date)	(Tianjin Municipal People's Congress, November 12, 2004)

Main Content

1. This regulation defines technology transactions as transactions involving technology development, technology transfer, technology consulting, technology services, etc. The city's science and technology administrative department is responsible for planning, coordinating, and managing technology transaction activities within the city's administrative region.

2. Technology transaction activities can be conducted through various channels such as technology sales negotiation conferences, seminars, information dissemination meetings, science and technology bazaars, permanent technology markets, technology intermediary services, etc., in forms such as technology bidding, technology contracting, technology auctions, joint research and production collaboration, etc.

3. The government takes measures to support and protect technology transactions conducted by research organizations and researchers in the form of technology capital.

4. Technology transaction services refer to the provision of technology transaction venues, technology transaction management services, technology transaction consulting services, technology transaction legal services, technology evaluation services, technology information services, etc.

5. Technology suppliers engaged in technology transactions can use 20-40% of the net income associated with the technology as compensation for related personnel by registering the technology contract. Companies that acquire new technologies can temporarily withdraw 10-30% of the new profits for the purpose of rewarding related personnel within one year from the day profits increased due to the adoption of new technologies.

Regulation Name	"Interim Measures for Further Promoting the Transformation of High-Tech Achievements" ("关
(Issuing Department and	于进一步促进高新技术成果转化暂行办法")
Implementation Date)	(Tianjin Municipal Science and Technology Bureau, March 22, 2005)

Main Content

1. The project certification office is responsible for recommending certified transformation projects to relevant institutions, and commercial banks can prioritize lending to those who meet the conditions for bank financing. Project organizations can apply for secured loans from banks conducting patent right collateral services, guaranteed by science and technology guarantee institutions. In addition, the stock market listing of companies working on high-tech achievement transformation projects will be preferentially recommended. Among similar products, the government prioritizes the procurement of products resulting from the transformation of high-tech achievements.

2. Organizations and individuals engaged in technology transfer, technology development, and related technology consulting and services resulting from transformation projects are exempt from business tax.

3. Participation of production factors, such as technology and management, shall be encouraged in the distribution of profits. Enterprises, research and development institutions, and universities are to reward those who have achieved scientific and technological achievements and others who have made significant contributions to the transformation of these achievements according to different transformation methods.

4. The establishment of venture capital institutions by all capital, including private capital, both domestic and international, is to be encouraged. Approved venture capital institutions are allowed to invest their entire capital.

5. The Tianjin Technology Property Right Exchange Organization is to fully utilize its service functions for technology property rights and stock transactions. Mechanisms for the entry and exit of venture risk investment and financing for the transformation of scientific and technological achievements and the growth of science and technology-type companies are to be established, promoting a virtuous cycle of venture capital.

Regulation Name	"Tianjin Municipality Regulations on Promoting the Transformation of Scientific and
(Issuing Department and	Technological Achievements" ("天津市促进科技成果转化条例")
Implementation Date)	(Tianjin Municipal People's Congress, July 26, 2017)

1. The city shall establish and improve an information system to promote the transformation of scientific and technological achievements. The city's science and technology administrative department shall establish an information bank for scientific and technological achievements, publicize information about the implementation status of scientific and technological projects and scientific and technological achievements to the public, and provide services such as inquiries and screening of scientific and technological achievements information, but must not disclose state secrets or commercial secrets. The city's intellectual property rights department shall improve the patent information service platform, conduct searches, processing, and analysis of patent information data, and promote the utilization of patents.

2. Research institutions and universities should improve the management system for the transformation of scientific and technological achievements, optimize the process of transforming scientific and technological achievements, and strengthen their specialization in the transformation of scientific and technological achievements. Enterprises are to be encouraged to play a major role in selecting the direction of research and development, implementing projects, and applying results, as well as support the expansion of research and development investments, the establishment of technology research and development institutions, research and development of key core technologies, and undertake the transformation of scientific and technological achievements domestically and abroad. The municipal and district people's governments shall encourage the establishment of various specialized service institutions for the transformation of scientific and technological achievements. (1) Collection, selection, analysis, and processing of information on scientific and technological achievements, (2) Agency services for scientific and technological achievement transformation of scientific and technological achievements, (4) training personnel for the transformation of scientific and technological achievements, (5) Incubation services for science and technology startups, (6) Other services for the transformation of scientific and technological achievements.

3. Those engaged in technology transactions shall conclude technology contracts in accordance with the relevant provisions of the Contract Law of the People's Republic of China. If registration is required after the conclusion of a technology contract, the developers of technology development contracts, the transferrers of technology transfer contracts, and the contractors of technology consulting and technology service contracts must apply for registration with the technology contract registration institution in their locality.

Regulation Name	"Tianjin Municipality Management Measures for Technology Transfer Demonstration
(Issuing Department and	Institutions" ("天津市技术转移示范机构管理办法")
Implementation Date)	(Tianjin Science and Technology Commission, November 13, 2017)

1. For the purposes of these measures, technology transfer refers to the process of transferring systematic knowledge related to the manufacturing of a product, the application of a process, or the provision of a service from technology suppliers to those requiring technology through various routes. A technology transfer organization is not an organization that simply provides services such as information, law, consulting, and finance. It refers to an organization that realizes and transforms technology transfer and achievements, such as technology management and administration, technology integration and operation, technology investment and financing services. These organizations provide various services to realize and accelerate the transfer and transformation of technologies.

2. Technology transfer organizations are an important component of a market-oriented, industry-academia-research integrated technology innovation system, playing a crucial role in facilitating the flow of knowledge and technology transfer.

3. The main function of technology transfer organizations is to facilitate the flow of knowledge and the transfer of technology. They have the following scope of work: (1) Collection, selection, analysis, and processing of technology information, (2) Technology transfer and representation services, (3) Technology integration and secondary development, (4) Pilot testing, engineering design services, technology standards, testing and analysis services, (5) Technology consulting, technology evaluation, technology training, technology property rights transactions, technology bidding representation, technology investment and financing services, (6) Provision of technology transfer.

4. Comprehensive technology transaction service institutions play a key role in connecting regions, research and development organizations, enterprises, and society, using public information service platforms to provide one-stop, network-based public services covering the entire process of technology transfer. To improve the specialization and quality of technology transfer services, the establishment of specialized technology transfer organizations is encouraged, and existing technology transfer organizations are encouraged to develop in the direction of specialization, focusing on one or several specific technology fields for providing technology transfer services.

5. Technology transfer organizations in Tianjin Municipality shall implement a registration system. Technology transfer organizations in Tianjin Municipality shall implement a certification system. The city's Science and Technology Commission shall integrate the development of technology transfer organizations and technology broker teams into the construction of the technology transfer innovation system, support the capacity building of technology transfer demonstration institutions, and provide a certain proportion of rewards to technology transfer organizations and technology brokers that have facilitated transactions.

Regulation Name""(Issuing Department and Implementation Date)T「(1)(1)(1)(1)(1)	"Tianjin Municipality Management Measures for Promoting the Transaction Projects from the Transformation of Scientific and Technological Achievements" ("天津市促进科技成果转化交 易项目管理办法") (Tianjin Science and Technology Commission, September 27, 2018)
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1. Projects that promote transactions from the transformation of scientific and technological achievements refer to technology development and technology transfer projects promoted by technology transfer organizations online and offline, which are certified and registered through technology contracts. Transaction projects eligible for subsidies include enterprises transforming or applying the scientific and technological achievements of research institutions and universities or organizations, or technology transfer organizations and technology brokers that have facilitated transactions. A technology transfer organization provides various transaction services online and offline to realize and accelerate technology transfer and the transformation of achievements. "Online technology transfer organizations" refers exclusively to the online platform of Tianjin Municipality's Science and Technology Achievement Exhibition Transaction Operation Center, a service institution that provides information resources, transaction specifications, and transaction guarantees for technology transfer. Offline technology transfer organizations are service providers that facilitate direct transactions by providing technology matching, intellectual property rights, and legal advice to both parties involved in the transaction.

2. For institutions that facilitate the completion of technology development and technology transfer transactions between domestic non-profit research and development organizations or universities and companies within the city, acting as the commissioning party or the transferee, support will be provided in three phases (First phase: July 1, 2018, to November 30, 2019; Second phase: December 1, 2019, to November 30, 2020; Third phase: December 1, 2020, to June 30, 2021), with subsidies capped at 2%, 1.5%, and 1% of the actual technology transaction amount for each respective period. The amount of subsidy for a single transaction shall not exceed 200,000 yuan. Technology transfer transactions: Institutions that promote domestic technology transfer transactions where the transferring side is a corporate organization in the city will be subsidized at a maximum of 1%, 0.8%, and 0.5% of the technology transaction volume of each phase, respectively. The amount of subsidy for a single transaction shall not exceed 100,000 yuan.

3. Technology transfer organizations shall allocate more than 30% of the subsidy to reward technology brokers who have actually contributed to facilitating the transaction of results, with the distribution made by the technology transfer organization according to the actual contribution of the technology broker

Regulation Name	"Science and Technology Business Incubator Management Measures in Tianjin" ("天津市科技
(Issuing Department and	企业孵化器管理办法")
Implementation Date)	(Tianjin Municipal Science and Technology Bureau, May 20, 2019)

1. The main function of incubators is to focus on the growth needs of science and technology-type enterprises, gather various types of factorial resources, promote science and technology-based innovation and entrepreneurship, and provide services such as entrepreneurial spaces, shared facilities, technical services, consulting services, investment and financing, entrepreneurial guidance, and resource matching.

2. To apply for a city-level incubator, the following conditions must be met: (1) Registered in the city, has an independent corporate status, clear development direction, a flawless operational management system, and incubation service system, has operated for 2 years since registration, and has reported true and complete "Torch Statistics"⁹¹ for at least one year, (2) Has centralized incubation facilities with at least 5000 square meters of freely usable incubation space. Of which, the area used by incubated enterprises (including the public service area) accounts for at least 75%, (3) The incubator has at least 2 million yuan of its own seed funds or cooperative incubation funds, the proportion of incubated enterprises receiving investment and financing is more than 10%, and there is at least one example of capital use, (4) The incubator has an expert service team, and expert incubation service staff (staff specialized in incubation with experience in entrepreneurship, investment and financing, management, or who have received training related to entrepreneurship services) make up at least 80% of the institution's total staff. For every 10 incubated enterprises, there is at least one expert incubator averages 3 companies per 1000 square meters, (6) The incubator has at least 5 graduated companies.

3. The Municipal Science and Technology Bureau conducts regular evaluations and assessments of city-level incubators and manages them dynamically. The results of the evaluation and assessment are divided into four grades: "excellent," "good," "pass," and "fail." City-level incubators that achieve excellent evaluation and assessment results will be awarded a one-time grant of 200,000 yuan, and those with good results will receive 100,000 yuan. Each district considers its regional advantages and practical needs, guiding the development of incubators towards specialization, and supports the establishment of specialized incubators by leading enterprises, universities, research and development institutions, new-type research and development institutions, and investment institutions.

⁹¹ Torch Statistics: A quantitative and comprehensive consideration of the scientific and technological activities and economic activities of all organizations involved in the Torch Plan. They are an important means to comprehensively assess, evaluate, and track the development of China's high-tech industries. The statistics serve as foundational material for the creation of development plans and activity plans for high-tech industries and constructing environments, and for determining development strategies. (The Torch Plan is a major national project aimed at the development, accumulation, and promotion of high-tech industries, started in August 1988.)

Regulation Name	"Tianjin Science and Technology Innovation Three-Year Action Plan (2020-2022)" ("天津市科
(Issuing Department and	技创新三年行动计划》(2020—2022年))
Implementation Date)	(Tianjin Municipal People's Government, November 21, 2020)

1. A high-level technology transfer system is to be built. Centered around the city-level science and technology achievement transaction platform, four types of technology transfer organizations, including regional, university, industrial, and service, are to be maintained, building a technology transfer network interconnected with domestic and international technology markets, and the construction of a team of technology transfer experts including results evaluators and technology managers is to be promoted.

2. The fluidity of the technology market is to be promoted. Platforms for the market-oriented circulation of scientific and technological achievements, such as exhibitions and transactions of scientific and technological achievements, supply and demand matching, and financing for achievements, are to be built, databases of scientific and technological achievements and databases of technological needs of enterprises are to be established, and the brand activity "俏津门" (Scientific and Technological Achievements in Tianjin) is to be launched. The securitization of intellectual property in the Binhai New Area is to be considered.

3. The sense of blockages and difficulties in implementing achievement transformation policies is to be broken through. The proportion of technology contract transaction indicators in the evaluation of the city's science and technology awards is to be increased. Universities and research and development institutions are encouraged to fully implement the reform of rights to use, process, and profit from scientific and technological achievements, and experimentally grant ownership or long-term rights of use of scientific and technological achievements. The implementation of tax policies for cash rewards for scientific and technological achievements. The implementation of a policy of replacing personal income tax with bonuses for individuals who have made significant contributions to the transformation of scientific and technological achievements and effort exemption system is to be implemented to ensure that personnel who have fulfilled their duty of care and effort in the transformation of scientific and technological achievements are not negatively evaluated.

4. The transformation of scientific and technological achievements in Beijing is to be actively undertaken. The great historical opportunity of synergistic development among Beijing, Tianjin, and Hebei is to be seized, collaboration with the Chinese Academy of Sciences, Chinese Academy of Engineering, Tsinghua University, and Peking University is to be strengthened, and the construction of the Tianjin branch of the University of Chinese Academy of Sciences School of Engineering and Biology (provisional name), Tianjin Branch of China Academy of Chinese Medical Sciences, and Tianjin Branch of Chinese Academy of Medical Sciences is to be promoted. Construct Beijing-Tianjin joint innovation centers such as the Binhai-Zhongguancun Science Park, Baodi Beijing Tianjin Zhongguancun Science and Technology City, and Wuqing Jingjin Industrial New City. In districts like Dongli, Beichen, Jinnan, and Jinghai, support the development of Beijing/Tianjin Micro-Innovation Centers and a radiology service center district in Xiong'an New Area.

Regulation Name	"Tianjin Science and Technology Innovation '14th Five-Year' Plan" ("天津市科技创新"十四五"
(Issuing Department and	规划")
Implementation Date)	(Tianjin Municipal People's Government, August 8, 2021)

1. Incubation and transformation are positioned as important steps, focusing on improving the capability of transforming scientific and technological achievements. Focus is to be placed on building a technology innovation system that integrates enterprises, academia, and research, with enterprises as the main body.

2. The principle of starting businesses through utilization is to be adhered to, promoting the transfer and transformation of scientific and technological achievements. The achievement transfer and transformation service system is to be improved, smoothing the transformation chain of achievements, and promoting the market-oriented flow of technology factors. The integration of science, technology, and finance is to be promoted, building a science and technology financial support service system that covers the entire lifecycle of science and technology-type enterprises.

3. The construction of national and city-level demonstration zones for the transfer and transformation of scientific and technological achievements is to be promoted, creating advantageous locations for implementing transformation policies. Through pilot and experimental implementation, new models for the transfer and transformation of achievements that are demonstrable and can be disseminated are to be developed, reflecting the unique characteristics of each region. A professional service system is to be built, developing routes for inflowing domestic and foreign technologies, talents, and resources, that introduces the innovation resources of the China Association for Science and Technology, and provides services for key industries and regional economic development.

4. Centered on the city-level technology achievement transaction platform, the development of four types of technology transfer organizations including regional, university, research and development institutions, industry, and services is to be promoted, building a technology transfer network interconnected with domestic and international technology markets

Regulation Name	"Opinions on Implementing Improvements to the Scientific and Technological Achievement
(Issuing Department and	Evaluation System" ("关于完善科技成果评价机制的实施意见")
Implementation Date)	(Tianjin Municipal People's Government, March 03, 2022)

1. Allow research and development organizations autonomy in the use, processing, and profit distribution of scientific and technological achievements, deciding on transformation methods such as transfer, licensing, converting scientific and technological achievements into shares or investment ratios independently, and determining prices through agreed prices, public listings, auctions, etc. Public welfare category one organizations⁹² can, according to regulations, earn income from the transformation of achievements in technology development, technology consulting, and technology services.

2. The construction of technology transfer organizations within research and development organizations is to be strengthened. Research and development organizations must improve their coordination mechanism for achievement transformation, establish specialized technology transfer organizations, set up corresponding positions for technology transfer, and establish corresponding evaluation and recruitment systems. These institutions can operate independently or in conjunction with social organizations, employing full-time and part-time technology managers.

3. Technology transfer organizations are to be developed socially. Government purchases of services will support the market-oriented operation of city-level transaction platforms, nurturing various types of technology transfer organizations classified as universities, research and development institutions, industries, regions, services, etc. These technology transfer organizations will be guided to build market-oriented cooperation mechanisms and investment institutions and intellectual property rights service institutions will be encouraged to expand their technology transfer functions.

4. The technology transaction market is to be improved. The development of technology exchanges is to be supported, clarifying operating procedures such as public listing of scientific and technological achievements, aiming for the soundness of diverse market transaction price models, such as agreed prices, of scientific and technological achievements, and guiding universities, research and development institutions, and enterprises to trade scientific and technological achievements in the market.

5. The evaluation mechanism for scientific and technological achievements and the collaboration mechanism between financial institutions and investment companies are to be improved, guiding related financial institutions and investment companies to evaluate the potential economic value, market value, and development prospects of scientific and technological achievements on a commercial basis. The knowledge value credit lending model is to be promoted through matching activities between banks and enterprises, expanding the scale of intellectual property rights secured financing. The construction of a national intellectual property rights operation service system trial city in the Binhai New Area is to be promoted, considering the securitization of intellectual property rights on the premise that these rights are recognized and can generate stable cash flows

⁹² Public welfare category one organizations: Organizations that undertake the most basic public welfare services such as basic education, scientific research, culture, and health, which cannot be allocated by the market or are not suitable for market allocation, and thus assume these public functions through the establishment of organizations.

(5) Shandong Province

Regulation Name (Issuing Department and Implementation Date)	"Opinions on the Implementation of Developing the Science and Technology Service Industry in Accordance with the State Council's No. 49 [2014] Directive" ("关于贯彻国发 [2014] 49 号 文件 ⁹³ 加快科技服务业发展的实施意见") (Shandong Provincial People's Government Office, June 9, 2015)
Main Content	

1. By the end of 2015, the planning and deployment of the province's science and technology service industry's development is to be essentially completed, cultivating more than 800 key institutions of various science and technology services. By 2017, the policy environment and innovation system for the development of the science and technology service industry is to be significantly optimized, fundamentally improving the science and technology service chain including science and technology finance, intellectual property rights, enterprise incubation, technology transfer, etc., and cultivating more than 1200 key organizations of various science and technology services. By the end of the 13th Five-Year Plan period, a science and technology service system covering the entire chain of science and technology innovation is to be basically established, significantly enhancing the capability to contribute to science and technology innovation, and significantly improving the marketization level and core competitiveness of science and technology services.

2. To serve as the province's science and technology information resource and sharing platform, services such as scientific and technological information consulting and searching are to be provided to the public. To serve as the province's science and technology achievement transformation service platform, the online technology market transaction mechanism is to be improved, and a unified and open technology market service system is to be built integrating online and offline. The Weifang Patent Navigation Industry Development Pilot Zone and Patent Navigation Technology Research Institute are to be established, the service scope of the Yantai Industrial Navigation Service Platform is to be expanded, considerations are to be made regarding establishing a platform for comparison services of Chinese and foreign technology standards and patents, and support for the development of Shandong Province's patents, standards, and technology navigation industry is to be provided.

3. The incubation model is to be innovated. Group innovation spaces are to be created and support provided for all new carriers to produce mass entrepreneurship and innovation. New entrepreneurial service platforms such as "Angel Investment + Entrepreneurship Mentors + Professional Incubation" are to be actively built, with innovation factors such as industrial resources, entrepreneurial capital, high-end talents, and various service agencies on a market basis to be accumulated in incubators, and the promotion of the provision of high-quality value-added entrepreneurial services to incubated enterprises to be promoted.

4. The cultivation of diverse forms of investment funds is to be pursued. The establishment of a sound risk compensation mechanism for science and technology credit is to be undertaken. Construction of expert institutions of science and technology finance is to be strengthened. Intellectual property rights secured loans are to be provided. Financial institutions such as banks and guarantors are to be encouraged to provide intellectual property rights secured financing to Science and Technology Intermediary Agents. The role of science and technology collateral services is to be emphasized. Through the provincial science and technology loan guarantee platform, the government, banks, and guarantee companies will share risk models to fully meet the financing and credit needs of Science and Technology Intermediary Agents. Routes for fundraising in the capital market are to be expanded. The listing of eligible Science and Technology Intermediary Agents on regional equity exchanges, unlisted stock markets, or GEM⁹⁴, some listed markets, and overseas public markets is to be actively promoted.

5. Improvements to the science and technology service industry chain, centered on industrial clusters, are to be achieved. The differentiated development of the science and technology service industry, in alignment with regional development strategies, is to be promoted. Pilot projects on the innovative development of the science and technology service industry are to be carried out.

6. Productivity Promotion Centers, incubators, testing and certification agencies, and other organizations equipped with the necessary conditions are to be separated from administrative departments, transitioning them into enterprises. This aims to cultivate a significant number of science and technology intermediary backbone enterprises and enhance the marketization level of science and technology services. The steady implementation of preferential tax policies for the education expenses of employees of Science and Technology Intermediary Agents and the income tax of high-tech enterprises is to be ensured, along with the expansion of the scope of the pre-stage tax amount deduction in the VAT⁹⁵ for Science and Technology Intermediary Agents.

- ⁹³ "Several Opinions on Accelerating the Development of the Science and Technology Service Industry (State Council)" ("国务院关于加快科技服务业发展的若干意见")
- 94 GEM (Growth Enterprise Market): A stock market for small and medium-sized venture companies established at the Shenzhen Stock Exchange in May 2009. Also known as the Chinese version of Nasdaq.
- ⁹⁵ Value-Added Tax (VAT): A tax applied to the sale, processing, repair, and maintenance services for goods, and the import of goods. Although it is initially applied to export sales, it is then refunded, resulting in a zero tax rate.

Regulation Name	"Opinions on Accelerating the Development of the Technology Market in the Whole Province"
(Issuing Department and	("「关于加快全省技术市场发展的意见")
Implementation Date)	(Shandong Provincial People's Government, June 17, 2015)

1. The goals for the development of the provincial technology market are to be clarified. Based on the principles of "provincial and municipal joint construction, openness and sharing, promotion of transformation," an open and shared technology market system is to be built by combining public services with market-oriented operations, online platforms with organizations, and technological factors with functional services.

2. The unified online technology transaction platform system of the whole province is to be improved. Basic data platforms for technology supply and demand, financing services, intellectual property rights, policies and regulations, intermediary services, and professional talents are to be built by utilizing modern information technology means such as cloud computing, big data, mobile e-commerce, the Internet of Things, etc.

3. The multi-level technology transaction system is to be expanded. Based on the requirements of online and offline transactions, the planning and guidance of the offline technology market's construction are to be strengthened, the scale of existing technology markets is to be integrated and expanded, the establishment of technology transfer organizations by social forces is to be encouraged, and a system of technology transfer organizations intertwined with regions and industries is to be built.

4. Emerging service industries tailored to technology transactions are to be cultivated. New forms of science and technology service industries with features of technology transaction services are to be actively developed, and the establishment of a new technology transaction intermediary service system that realizes flawless services and efficient allocation of various science and technology resources is to be considered. Based on the demand for transfer and transformation of scientific and technological achievements the cultivation of technology transaction intermediary service organizations engaged in specialized services such as technology consulting, pilot bases, evaluation, testing and transformation of achievements, intellectual property rights agency services, and science and technology finance is to be accelerated. Technology transaction intermediary service organizations are to be dynamically selected and experimental implementations of innovations in technology transaction service business models are to be carried out.

5. Internal and external collaboration in the technology market is to be promoted. Technology transaction organizations, technology transaction intermediary service organizations, high-tech parks, universities and research and development institutions, and enterprises equipped with conditions are to be encouraged to undertake multi-level cooperation. Technology transaction platforms are to be encouraged to interconnect with various professional market platforms and provide cross-market integrated services

Regulation Name	"Opinions on Deepening the Reform of the Science and Technology System and Accelerating
(Issuing Department and	the Development of Innovation" ("「关于深化科技体制改革加快创新发展的实施意见")
Implementation Date)	(Shandong Provincial People's Government, July 26, 2016)

1. The government's science and technology management functions are to be transformed. A new model of "Internet + science and technology services" is to be constructed, centering on the market playing a decisive role in resource allocation and the government playing its role properly, to provide convenient and rapid public services through various entities of innovation.

2. The mechanism for the transformation of scientific and technological achievements is to be improved. A one-time reward of 6 million yuan from provincial finances will be received by technology transfer organizations that undertake tasks related to major provincial scientific and technological achievements and fall within the scope of demonstrative national technology transfer organizations. A market employment system for technology managers is to be introduced. The construction of scientific research pilot bases is to be strengthened, and through a flexible mechanism, the enthusiasm of industry, academia, and research is to be coordinated, and research and development, pilot testing, transformation, and industrialization are to be realized in an integrated manner.

3. Science and technology-related associations are to be actively developed. The development of Science and Technology Intermediary Agents such as for technology transfer, testing and certification, entrepreneurship incubation, intellectual property rights, etc., is to be supported, and brands of various STIAs with significant influence are to be cultivated. Teams of technology managers and patent agents are to be cultivated. New-type research and development institutions which are independent legal entities and comply with standards are to be accredited. These are institutions with diversified investment subjects, market-oriented operation mechanisms, modernized management systems, and closely integrated industry, academia, and research.

4. Policies supporting the science and technology service industry are to be improved. Science and technology public service projects are to be included in the government's guidance catalog for services purchased from social forces, and the necessary funds for this are to be included in the fiscal budget. Utilizing the provincial service industry development guidance fund, research and development and application demonstration of science and technology service industry support technologies, talent recruitment and development, and platform construction are to be included as key areas of support. Policies are to be implemented to set the prices of utilities such as water, electricity, gas, and heating for the science and technology service industry to be equivalent to those of industry. Related preferential policies such as accelerated depreciation of fixed assets are also to be implemented.

5. Innovation, entrepreneurship incubation, and service capabilities are to be strengthened. Incubation experience is to be separately leveraged. Leading enterprises are to be encouraged to establish specialized incubators according to their own technical needs or the needs of primary industries and to provide incubation services to upstream and downstream science and technology-type micro / small and medium-sized enterprises. The provision of a certain proportion of industrial park land for incubator construction annually is to be encouraged in each city. Registration systems for academicians' workstations, provincial-level group innovation spaces, and incubators are to be provided. Innovation and entrepreneurship models such as mass innovation / crowdfunding ("衆筹") crowdsourcing ("衆包"), collective support ("衆扶"), and virtual innovation and entrepreneurship communities are to be actively and steadily developed. By 2020, over 100 national-level group innovation spaces are to be created.

6. The level of sharing and utilization of science and technology resources is to be raised. A scientific and technological achievements information system is to be constructed, the development and utilization of data resources from scientific and technological achievements are to be strengthened, the sharing mechanism of services related to scientific and technological reports is to be improved, and the transformation of scientific and technological achievements is to be promoted
| Regulation Name | "Regulations on Promoting the Transformation of Scientific and Technological Achievements in |
|-------------------------|--|
| (Issuing Department and | Shandong Province" ("山东省促进科技成果转化条例") |
| Implementation Date) | (Shandong Provincial People's Congress, December 1, 2017) |

1. Activities to promote the transformation of scientific and technological achievements should respect scientific and technological innovation and market discipline, with enterprises playing a leading role. Specific indication is to be provided for the direction of knowledge value distribution, and the principles of voluntariness, mutual benefit, fairness, justice, and credibility are to be followed, thereby protecting the legal rights and interests of organizations and individuals involved in the transformation of scientific and technological achievements and enhancing economic, social, and ecological benefits.

2. Research institutions and universities are to be encouraged to transfer scientific and technological achievements to enterprises and other organizations through means such as transfer and licensing. Government-established research institutions and universities can independently decide on the implementation, transfer, and licensing of their own scientific and technological achievements.

3. People's governments at the provincial, city, and county (city, district) levels with the necessary conditions should build public research and development platforms according to the needs of industrial and regional development, and provide services such as technology integration, general technology research and development, pilot and industrial testing, systematization and engineering of scientific and technological achievements, and technology dissemination and demonstration through the transformation of scientific and technological achievements.

4. The science and technology administrative departments of provincial governments should establish evaluation mechanisms for the operation of incubators and guide and support incubators in providing entrepreneurship incubation sites, entrepreneurship guidance, research and development, management consulting, financing, market development services, etc., for science and technology-type small and medium-sized enterprises.

5. Provincial and city people's governments should establish mechanisms to compensate for the risks of transforming scientific and technological achievements, guide financial institutions to innovate financial products, and optimize financial services. A science and technology financial service platform is to be constructed, and lending support for the transformation of scientific and technological achievements for enterprises, research institutions, and universities is to be strengthened. People's governments at the county level and above should support enterprises in utilizing multilevel capital markets for fundraising through direct financing such as listing, bond issuance, private equity funds, etc., for the transformation of scientific and technological achievements. Science and technology achievement transformation guidance funds established by provincial people's governments should guide social capital and local government funds to initiate or participate in the establishment of science and technology achievement transformation sub-funds to promote the transformation of scientific and technological achievements.

Regulation Name"C(Issuing Department andthImplementation Date)紧(S	Opinions of Shandong Provincial People's Government on Accelerating the Construction of he Technology Transfer System in the Province" ("山东省人民政府关于加快全省技术转移体系建设的意见") Shandong Provincial People's Government, May 31, 2018)

1. By 2020, the province is to have fundamentally built an online technology market system complemented by specialized technology markets, form a new scheme for the transformation of scientific and technological achievements covering all cities and counties (cities, districts) in the province through online and offline, horizontal and vertical integration, connection of domestic and foreign technology transfer organizations, and joint innovation by government, industry, academia, research, finance, service, and users. Over 50 national technology transfer demonstration organizations, over 20 provincial-level technology transfer platforms, and over 200 provincial-level technology transfer service organizations are to be cultivated, aiming for the province's annual technology contract volume to exceed 80 billion yuan and the average annual growth rate to be over 20%.

2. The market system is to be improved. Technology markets are to play an important role, with the construction of national demonstration zones for the transfer and transformation of scientific and technological achievements in Jinan, Qingdao, and Yantai is to be emphasized, with each city providing simultaneous leadership and promotion of these efforts. Construction of provincial-level platforms such as Shandong Province Technology Achievement Trading Center (Jinan) and Shandong Province Technology Transfer and Transformation Center (Dezhou) is to be accelerated. The Qingdao National Marine Technology Transfer Center is to play a demonstrative and leading role in promoting the innovation and upgrade of regionally advantageous industries. The new advantages of Internet + science and technology services are to be leveraged to build the Shandong Province Online Technology Market System.

3. The cultivation of technology transfer organizations is to be actively pursued. Technology transfer organizations with the necessary conditions are to be supported to establish investment funds in cooperation with angel investors and venture capital, lending models for the entire process from experimental research and pilot testing to production are to be established, and the capitalization and industrialization of scientific and technological achievements are to be promoted. The development of the technology management service industry is to be accelerated, technology managers are to be actively recruited and cultivated, and high-level technology transfer talents who have achieved excellent results are to be included in the high-level talent support program of the province and city. Financial institutions and market investment institutions such as venture investment are to be encouraged and guided to strengthen support for the transformation of scientific and technological achievements. Institutions at all levels within the state are to fully utilize the National Guiding Fund for the Transformation of Scientific and Technological Achievements and the province's New and Old Growth Drivers Fund, establish venture capital sub-funds, continue to implement risk compensation policies for science and technology achievement transformation loans, and promote the acceleration of the transformation of scientific and technological achievements. Five lending service models of evaluation, guarantee, lending, investment, and trading are to be actively promoted, and credit provision to science and technology-type small, micro, and medium-sized enterprises is to be expanded. Integration across academic disciplines and enterprises is to be promoted by combining enterprises upstream and downstream of the industrial chain, leading synergistic innovation in all aspects of research and development, manufacturing, and services, and supporting activities for the transformation of scientific and technological achievements such as technology concept demonstration and commercial development.

4. The order of the technology market is to be strictly regulated, and innovation is to be produced in methods of trading scientific and technological achievements. The normalization and standardization of bidding activities are to be realized, the content of online and offline technology market services is to be further enriched, and all types of legitimate transactions such as technology transfer, joint development, commissioned development, human capital participation, and patent licensing are to be encouraged

Regulation Name (Issuing Department and Implementation Date)	"Several Opinions on a Sound Market-Oriented System for Science and Technology Innovation by the People's Government of Shandong Province" ("山东省人民政府关于健全科技创新市场 导向制度的若干意见") (Shandong Department of Science and Technology, October 17, 2019)
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1. The reform of the provincial science and technology planning system is to be advanced, the integration of special funds for science and technology innovation is to be expanded, and a unified management platform for provincial science and technology planning is to be constructed. In research projects, the focus is to be shifted from the initiation of projects to focusing on project performance and breakthrough achievements. The research project expense management system is to be reformed, and considerations regarding establishing a "Baoganzhi(包干制)"⁹⁶ system for research project expenses are to be made. The classification and evaluation system for research projects is to be improved.

2. An industry-academia-research cooperation innovation mechanism is to be constructed where companies propose themes, and researchers apply to research them, encouraging companies to promote the integrated construction of projects, talents, and platforms. Special projects that fully cover large enterprises' research and development institutions are to be implemented, supporting the pioneering construction of high-level research and development platforms. The promotion of innovative products and services is to be enhanced, and support is to be expanded by applying non-bidding methods such as first purchase or purchase reservations.

3. Based on the trial of reforms in the science and technology system of universities, the autonomy of universities and research institutes is to be further enhanced in aspects such as job setting, internal organization adjustments, staff employment, salary distribution, and fund management. Reforms that grant researchers ownership or long-term usage rights of scientific and technological achievements are to be implemented, changing "convert first, reward later" to "confirm rights first, convert later." Support for innovation and entrepreneurship amongst research and development personnel is to be encouraged.

4. The overall layout of national and provincial innovation platforms is to be optimized, and the management system of various innovation platforms is to be reformed and improved. The policy of open sharing of important research infrastructure and large research equipment is to be improved. More proactive policies to support new-type research and development institutions are to be deployed. The construction of Shandong Industrial Technology Research Institute, Institute of Advanced Technology, and Energy Research Institute is to be accelerated, and the establishment of strategic industrial technology innovation alliances through industry-academia-research cooperation led by enterprises is to be encouraged.

5. An open, efficient, and expert technology market system is to be established, and financial subsidy policies for science and technology achievement transfer and transformation service organizations are to be improved. Universities and research and development institutions affiliated with the province are to be able to independently decide on the transfer, licensing, etc., of their scientific and technological achievements as a policy to encourage the transformation of these achievements. The creation and operation of intellectual property rights is to be supported.

6. To promote the effectiveness of policies, the adjustment mechanisms for deepening the reform of the province's science and technology system are to be improved, proposing that Shandong Province's science and technology guidance group play a guiding and coordinating role and that the coordination mechanism for macroscopic decision-making in science and technology be improved. Municipalities and direct provincial departments (organizations) are to strengthen business guidance and supervision. Provisions that contradict the spirit of newly introduced policies are to be eliminated and amended, and in addition, experimental approaches are to be adopted to examine institutional issues encountered in the process of policy implementation through experimental project methods

⁹⁶ 包干制: A system where a total amount of expenses is determined, but there is no need to organize a detailed budget for expense items. Research and development personnel can use and allocate expenses according to actual needs and regulations during the research process, thereby reducing the burden on researchers. Mentioned for the first time in a 2019 government activity report.

Regulation Name	"Plan for the Creation of Advanced Regions (Cities, Districts) for Technology Transfer in
(Issuing Department and	Shandong Province" ("山东省技术转移先进县(市、区)创建活动方案")
Implementation Date)	(Shandong Department of Science and Technology, November 18, 2019)

1. The government's role in policy formulation, platform construction, and personnel training for the transfer and transformation of scientific and technological achievements is to be strengthened, and a favorable environment for the transfer and transformation of scientific and technological achievements is to be created. A focus on the needs of industrial transformation and upgrading is to be maintained, allowing the market to play a decisive role in resource allocation, and promoting the effective concentration of technology, capital, and other factors.

2. Over three years from 2019 to 2021, 50 advanced regions (cities, districts) with a good industrial base, strong transformation capability, comprehensive policy support, and notable demonstration effects are to be created, fully playing a leading and promoting role in demonstration, accelerating the construction of the province's technology transfer system, and forming a new pattern of transfer and transformation of scientific and technological achievements in the province.

3. The evaluation indicators for advanced technology transfer regions (cities, districts) mainly include regional technology market management, technology transfer platforms, technology transfer service institutions and personnel, support for technology transfer to the economy and society, and major transfer and transformation projects, etc. The Provincial Department of Science and Technology will grant the trademark of "Advanced Region (City, District) for Technology Transfer in Shandong Province" to the establishment entities and use the results of the establishment as an important reference indicator for the regional science and technology innovation evaluation index and give priority support to the construction of online technology transfer service platforms at the regional level.

Regulation Name	"Action Plan for Upgrading Next-Generation Information Technology Innovation Capabilities
(Issuing Department and	in Shandong Province (2019-2021)" ("山东省新一代信息技术创新能力提升行动计划 (2019-
Implementation Date)	2021年)")
	(Shandong Department of Science and Technology, December 9, 2019)

Main Content

1. The integration and innovation of government, industry, academia, research, finance, and services is to enhance autonomous innovation capabilities for next-generation information technology, the innovation and application of next-generation information technologies such as artificial intelligence, big data, blockchain, and the Internet of Things are to be promoted, and next-generation information technology industry clusters are to be cultivated and expanded. In the field of next-generation information technology, a large number of innovative public service platforms such as technology transfer centers and testing and inspection centers are to be built. Leading companies in next-generation information technology are to be supported to take the lead in establishing industry technology innovation alliances, and collaborative research and development, patent sharing, and the establishment of industry standards, etc., are to be supported.

2. Various entities such as science and technology parks, enterprises, and social organizations should move towards specialization, marketization, and networking to build specialized incubation platforms for next-generation information technology such as incubators and group innovation spaces, and encourage research and development teams in fields such as artificial intelligence, the blockchain, big data, and the Internet of Things, as well as science and technology small and micro enterprises, to provide low-cost and smooth open services for all entities of innovation and entrepreneurship.

Regulation Name	"Construction Standards for Technology Innovation Centers in Shandong Province" ("山东省
(Issuing Department and	技术创新中心建设标准")
Implementation Date)	(Shandong Department of Science and Technology, December 03, 2020)

1. Provincial technology innovation centers are an important component of the provincial technology innovation system, promoting joint innovation among industry, academia, and research, and advancing the industrialization of significant basic research achievements. They are also vital innovation carriers that lead high-quality development amongst industry. Provincial technology innovation centers are located in the middle of the innovation chain, connected upwards to basic research in laboratories and downwards to industrialization in enterprises, promoting the research and development of important core technologies and the transfer and transformation of scientific and technological achievements, and paving the way from science to technology transformation.

2. The content of indicators for constructing a system for transforming research results is as follows. (1) An efficient science and technology service and achievement transformation mechanism is to be established, upstream and downstream science and technology resources are to be integrated, and channels for achievement transformation are to be opened, (2) Achievement transformation and industrial incubation are to be implemented, the engineering and industrialization of major achievements are to be steadily promoted, and the bottleneck of industrialization of scientific research achievements is to be broken through, (3) During the preparation period, the industry's high-end technologies and talent teams are to be gathered, more than 30 high-end talents are to be recruited, and more than 5 major scientific research achievements are to be transformed.

3. Technology innovation centers, through system innovation, are to effectively integrate advantageous scientific research and industrial resources at home and abroad and build an innovation platform where the upstream and downstream of the technology chain and industrial chain synergistically create efficient effects centered on technology breakthroughs, technology transformation, and technology leadership. Also, a joint research and development mechanism combining source innovation driving and market needs pulling is to be built, cooperation between enterprises and universities / research and development institutions as a whole is to be realized, and innovation consortia are to be established. The use of resources owned by companies such as software, hardware, and personnel is to be maximized, mainly providing market-oriented services such as joint research and development, industrial incubation, and industrial services to the entire industry. Technology innovation centers are to be constructed through joint investment, and participation in the decision-making of major matters of technology innovation centers is to be ensured. Joint investors can use technology innovation centers as a platform for customized research and development, implementation of competitive projects, construction of resource cooperation platforms, investment in incubation projects, sharing business opportunities, and enjoying preferential rights to information access and participation.

Regulation Name	"Notice on the '14th Five-Year' Plan for Scientific and Technological Innovation in Shandong
(Issuing Department and	Province" ("山东省"十四五"科技创新规划的通知")
Implementation Date)	(Shandong Provincial People's Government, September 11, 2021)

1. The construction of the technology market system is to be strengthened. The market-oriented allocation reform of technology factors is to be deepened, the property rights system for scientific and technological achievements is to be improved, and innovation is to be produced in the transformation mechanisms for scientific and technological achievements. Additionally, the construction of a modern technology trading market is to be considered, and a technology transfer service system is to be improved, forming a management mechanism that balances incentives and regulations, and building a modern technology market system that meets the needs of innovation development in the new era.

2. The reform of rights and interest management in scientific and technological achievements is to be deepened. The reform of the rights to use, dispose of, and benefit from scientific and technological achievements is to be deepened, considering granting researchers ownership or long-term usage rights of scientific and technological achievements, and increasing the proportion of revenue distribution among researchers. The distribution policy oriented towards enhancing the value of knowledge is to be deepened, and shareholding incentive reforms for leaders of business organizations affiliated with universities and research institutes with independent corporate status are to be implemented.

3. The service system for the transformation of scientific and technological achievements is to be made sound. The establishment of professional and market-oriented technology transfer organizations is to be strengthened. Comprehensive pilot projects on the transformation of scientific and technological achievements by universities and research institutes affiliated with the province are to be accelerated, and the establishment of technology transfer organizations is to be supported. Universities and research and development institutions are to be supported to establish concept proof centers for the early identification of projects with commercialization and socialization prospects.

4. The expert technology market is to be rapidly developed, and the market-oriented allocation function of innovation resources is to be strengthened. A monitoring and evaluation system for the technology market is to be built, the rules for the technology transactions and the public trading system are to be improved to strengthen the market allocation function of innovation resources, universities and research and development institutions are to be encouraged to enter the market for trading scientific and technological achievements, and collateral services for both parties in technology transactions are to be provided. The integration and development of technology and capital factors are to be promoted, and the comprehensive service system of technology property rights, value evaluation, flow trading, value guarantee, credit supervision, etc., is to be improved. The construction of technology broker teams is to be strengthened, and the expertise and professional awareness of technology transfer personnel are to be enhanced. The mechanism for the attribution of scientific and technological achievements, and profit distribution is to be improved.

5. Expert incubators based at large enterprises, universities, research and development institutions and new-type research and development institutions, are to be established, and public service platforms are to be built, aiming for the development of the Expert Science and Technology Business Incubator + Science and Technology Park model, and constructing an incubation cultivation chain of nursery through to incubation, acceleration, and industrialization.

Regulation Name	"Management Measures for the 'Government-Industry-Academia-Research-Finance-Service-
(Issuing Department and	User' Innovation and Entrepreneurship Community in Shandong Province" ("山东省"政产学
Implementation Date)	研金服用"创新创业共同体管理办法")
	(Shandong Department of Science and Technology, December 31, 2021)

1. The Provincial Department of Science and Technology is entrusted in the direction of issuing construction guidelines or democratically deliberating and deciding on them. The organizing entity planning construction is to compile the construction plan, clarifying the basis and functional positioning of construction, main tasks, expected goals, organizational structure, system mechanism, funding input, guarantee measures, etc., and submit the plan to the Provincial Department of Science and Technology.

2. The community should stand firm on integrating the innovation chain and industrial chain, design and deploy core tasks according to the entire industrial chain and the entire innovation chain, focus on the transformation and industrialization of achievements, incubation of high-tech enterprises, cultivation of listed companies, and cultivation of industrial clusters, and needs to create an excellent industrial innovation ecology.

3. The community should manage and use subsidies in accordance with national and provincial science and technology fund management regulations and the "Management Measures for Subsidy Funds of the 'Government-Industry-Academia-Research-Finance-Service-User' Innovation and Entrepreneurship Community in Shandong Province'.

4. The community should strengthen the protection and operation of intellectual property rights, and the community organizations should establish a patent outcome pool that can be commonly used

Regulation Name	"Shandong Province Science and Technology Business Incubation Carrier Management
(Issuing Department and	Measures" ("山东省科技企业孵化载体管理办法")
Implementation Date)	(Shandong Department of Science and Technology, September 19, 2022)

Main Content

1. Science and Technology Business Incubation Carrier is a collective term for group innovation spaces, incubators, accelerators, etc., serving as scientific and technological entrepreneurship service organizations aimed at promoting the transformation of achievements and nurturing technology-based enterprises and entrepreneurial spirit by providing physical space, shared facilities, and specialized services. They hold an important position in the province's science and technology innovation system. They also serve as crucial carriers for the incubation of high-tech companies, cultivation of innovative entrepreneurial talents, and support for mass innovation.

2. The main function of incubators is to focus on the growth needs of science and technology-type enterprises, gather various kinds of factor resources, promote science and technology-based innovation and entrepreneurship, and provide services such as locations, shared facilities, technical services, consulting services, investment and financing, entrepreneurial guidance, resource matching, etc., to promote enterprise growth, stimulate employment through entrepreneurship, and invigorate the overall innovation and entrepreneurial vitality of society. Furthermore, the main function of accelerators is to provide development space to accelerate the growth of high-growth science and technology-type enterprises, provide specialized technical platforms for small-scale trials or pilot tests, and offer detailed incubation services for large-scale development of companies such as technology research and development, capital collaboration, market expansion, thereby accelerating the increase in scale and strengthening of science and technology-type enterprises.

3. For incubators, the construction of a full-cycle incubation chain from group innovation space to incubator to accelerator is encouraged and the expansion and extension of incubation into the industrial and innovation chain is promoted. Incubators are to be encouraged to explore innovative incubation models, develop cross-regional incubation models such as incubation in other locations, and consider shared benefit models such as joint park construction and enclave economies. Incubators are encouraged to enhance integration, innovation and joint development, and actively collaborate with universities, research and development institutions, and key enterprises, as well as to build scientific and technological innovation platforms such as technology innovation centers and new-type research and development institutions, promote deep integration of industry, academia, and research, accelerate the transformation of scientific and technological achievements of incubated enterprises into actual productivity, and comprehensively strengthen the research and development and human resource service capabilities of small and medium-sized enterprises.

4. The provincial Department of Science and Technology is responsible for the dynamic management of incubators. The science and technology bureaus of each city need to strengthen their supervision of the daily operations of incubators.

Regulation Name	"Shandong Province Technology Transfer Service Organization Cultivation Support
(Issuing Department and	Management Measures" ("山东省支持培育技术转移服务机构管理办法")
Implementation Date)	(Shandong Department of Science and Technology, September 21, 2022)

1. The service organizations referred to in these measures are entities with corporate status registered within the province for the purpose of promoting the transformation of scientific and technological achievements, including new-type research and development institutions, intermediary organizations, universities, and specialized institutions for technology transfer established within research and development organization, that carry out intermediary, brokerage, and agency activities to facilitate others' technology transactions and receive corresponding fees. The technical contracts mentioned in these measures refer to contracts concluded between parties to establish mutual rights and obligations concerning technology development, transfer, licensing, consulting, or service contracts. Technical contracts should reflect the intermediary role played by service providers such as intermediary services and brokerage, and clarify the rights and obligations of technology providers, receivers, and service providers.

2. Service organization applicants must submit notification documents and related materials to the science and technology bureau of the city (district) or the provincial department with jurisdiction within the designated period each year. The science and technology bureaus of each city and the provincial department with jurisdiction shall strictly review the submitted notification materials, recommend qualified service institutions that have achieved excellent results, and include them in the registration scope of the province's service organizations.

3. The use of subsidies is mainly for service organizations to carry out technical transfer and achievement transformation services, such as condition preparation, business training, holding scientific and technological achievement promotion conferences, rewarding technology brokers, and other related expenses. Service organizations are encouraged to utilize technology brokers to enhance staff composition, strengthen service infrastructure and means, improve service functions, expand service areas, and continuously improve service and support provision capabilities for the transfer and transformation of scientific and technological achievements.

Regulation Name	"Opinions on Accelerating the Construction of a Science and Technology Strong Province in
(Issuing Department and	the New Era" ("关于加快推进新时代科技强省建设的实施意见")
Implementation Date)	(Shandong Provincial People's Government, November 25, 2022)

Main Content

1. A market-oriented achievement transformation system is to be constructed. The construction of the provincial technology property rights trading platform is to be strengthened, and a technology market system that covers the entire province with unified standards and shared resources is to be built. The proportion of scientific and technological achievement transformation in the performance evaluations of universities and research and development institutions is to be increased, and the establishment of specialized technology transfer organizations in provincial universities and research and development institutions is to be accelerated. The construction of a consortium for the transformation of scientific and technological achievements between enterprises, universities, and research and development institutions is to be supported, and the promotion of scientific and technological achievement transformation is to be accelerated. Multiple bases for cultivating technology transfer personnel are to be developed, and the construction of high-end technology broker teams is to be strengthened.

2. Renowned domestic venture capital institutions and their invested companies are to be attracted and amassed, and a number of provincial-level venture capital clusters and comprehensive venture capital service bases are to be cultivated. Key industry companies and social capital are to be supported, with incubators established and an incubation + investment model adopted for direct investment in incubated companies.

3. The science and technology finance model is to be innovated. The construction of the science and technology finance reform pilot zone in Jinan city is to be accelerated. A data-based credit supplementation + industrial trust model is to be considered to support the financing of science and technology-type small and medium-sized enterprises. The establishment of specialized science and technology insurance institutions with special functions to provide risk compensation for the research and development and product promotion projects of science and technology-type enterprises is to be considered. The loan risk compensation mechanism for the transformation of scientific and technological achievements is to be continuously improved

(6) Guangdong Province

Regulation Name (Issuing Department and Implementation Date)	"Several Opinions on Promoting the Development of the Science and Technology Service Industry" ("科学技術サービス業発展の促進に関する若干の意見」(「关于促进科技服务业发 展的若干意见") (Guangdong Provincial People's Government, December 5, 2012)
	(Guangdong Provincial People's Government, December 5, 2012)

Main Content

1. Research and development design services are to play an important role in enhancing industrial innovation capacity and support the transformation and sophistication of industrial structures by establishing a research and development design service system and promoting the development and growth of specialized research and development design service companies.

2. Services related to the creation, application, protection, and management of intellectual property rights are to be actively deployed, and standardized management is to be strengthened. The construction of provincial intellectual property rights service parks is to be accelerated, and the intellectual property rights service market is to be cultivated.

3. Market-oriented operation of inspection and testing institutions is to be promoted, and the level of specialized services is to be enhanced. Technical services for quality and safety inspection, testing, quarantine, measurement, and certification by third parties are to be cultivated. Inspection and testing technical service institutions are encouraged to provide individual certification services to enable the provision of comprehensive testing services.

4. The service system for the transformation of scientific and technological achievements is to be improved, and specialized and market-oriented services for the transformation of scientific and technological achievements are to be energetically deployed. The construction of technology transaction markets is to be promoted, and the establishment of technology transfer service institutions with various functions such as technology consulting and evaluation, achievement dissemination, and financing guarantees is to be encouraged.

5. The standardized and orderly development of science and technology consulting organization for scientific and technological evaluation, industrial ecosystem evaluation, scientific and technological bidding, and scientific and technological information is to be promoted, and they are encouraged to undertake government-commissioned scientific and technological consulting and service provision.

6. The construction of China Service Outsourcing Model Cities in Guangzhou and Shenzhen is to be vigorously promoted, along with the collaborative development of service outsourcing in Zhuhai, Foshan, Dongguan, etc., forming service outsourcing industry clusters with their own characteristics and mutual support.

7. The coordination and cooperation of science and technology financial resources, the construction of science and technology financial products and service models by venture capital institutions, banks, securities companies, and insurance institutions are to be promoted.

8. The categories of science and technology intermediary services are to be improved, and the quality of services is to be enhanced. The establishment of Science and Technology Intermediary Agents by research and development institutions, universities, and enterprises, leveraging the advantages of research talent, is to be encouraged

Regulation Name	"Guangdong Province Technology Market Regulations" ("广东省技术市场条例")
(Issuing Department and Implementation Date)	(Guangdong Provincial People's Congress, November 26, 2014)

1. The technology market referred to in these regulations includes technology development, technology transfer, technology consulting, technology contracting, technology investment, technology holding, technology operation, technology evaluation, and other technology transaction activities.

2. Holders of technological achievements can trade through means such as technology transfer. When job-related technological achievements are traded through technology transfer, a portion of at least 20% of the net profit obtained from the technology transfer shall be temporarily awarded to those who made significant contributions. When technology is valued and invested in shares, it is possible to take a share of at least 20% of the shares obtained from the valuation of job-related technological achievements. This share is awarded to those who made significant contributions, and the recipients will hold a portion of the profits in shares.

3. All levels of people's governments should actively support the development of rural technology markets. Relevant departments and organizations should actively promote the dissemination of advanced technologies such as new varieties, cultivation, pest control, water and soil resource protection and utilization, and high-value processing of agricultural products.

4. Organizations and individuals who have contributed to pioneering technology markets and technology trade will be commended and rewarded by the people's governments at all levels or by the science and technology administrative departments.

Regulation Name	"Guangdong Province Regulations on Promoting the Transformation of Scientific and
(Issuing Department and	Technological Achievements" ("广东省促进科技成果转化条例")
Implementation Date)	(Guangdong Provincial People's Congress, December 01, 2016)

Main Content

1. In promoting the transformation of scientific and technological achievements, it is necessary to respect scientific and technological innovation and market discipline and incorporate the distribution in value of intellectual labor. Moreover, the rights and interests of all parties involved in the transformation of scientific and technological achievements are to be protected, following the principles of shared benefits, fairness and openness, alignment of rights and obligations, emphasis on incentives and commitments, emphasis on economic and social benefits, and conservation of the environment and resources, thereby stimulating the vitality of innovation and entrepreneurship across society.

2. Universities and research and development organizations are to be encouraged to form entities for the transformation of scientific and technological achievements by becoming shareholders in the ownership or usage rights of tangible assets related to the transformation of scientific and technological achievements and intangible assets such as scientific and technological achievements themselves. The market revenue obtained by the entities responsible for the transformation of scientific and technological achievements can be incorporated into the budget management of the organizations, after related approval procedures, by universities and research and development institutions established with provincial funds and used for market-oriented management activities related to the transformation of scientific and technological achievements.

3. Enterprises can engage in personnel and knowledge exchange, technology transfer with universities and research and development institutions, share research and development facilities, and jointly establish scientific and technological special envoys, research and development platforms, technology transfer organizations, technology innovation alliances, etc., adopting a cooperation model among industry, academia, and research to jointly conduct research and development, application and dissemination of achievements, standardization research and formulation, etc.

4. The establishment of market-oriented Science and Technology Intermediary Agents that provide technical consulting and evaluation, dissemination of achievements, transaction management, and loan guarantee services for the transformation of scientific and technological achievements is to be supported. Science and Technology Intermediary Agents engaged in consulting related to the transformation of scientific and technological achievements, scientific and technological information services, etc., shall enjoy preferential policies for non-profit research and development according to regulations. Qualified Science and Technology Intermediary Agents are to be supported to undertake professional and technical projects commissioned by the government. Departments with jurisdiction over science and technology must formulate sound scientific and technological intermediary management regulations and strengthen the supervision and management of STIAs.

Regulation Name	"Opinions on Further Promoting the Transfer and Transformation of Scientific and
(Issuing Department and	Technological Achievements" ("关于进一步促进科技成果转移转化的实施意见")
Implementation Date)	(Guangdong Provincial People's Government, April 10, 2017)

1. Specifications for the collection and service of major scientific and technological achievement information are to be formulated, major scientific and technological achievements in various fields are to be collected and organized into a database, and information support for the transformation of scientific and technological achievements is to be provided.

2. Guidance is to be provided for the establishment of various scientific and technological achievement transformation organizations. Cities in the Pearl River Delta with the necessary conditions are encouraged to build national technology transfer centers and to cultivate and develop national-level and provincial-level technology transfer demonstration organizations. Universities and research and development institutions with the necessary conditions are encouraged to establish sound professional, market-oriented scientific and technological achievement transfer and transformation organizations. The technology transfer service activities of science and technology transfer organizations are to be encouraged.

3. The construction of technology transaction network platforms is to be promoted. An online technology transaction market that gathers innovation factors such as scientific and technological achievements, intellectual property rights, capital, personnel, services, etc., and connects innovation subjects such as universities, research and development institutions, enterprises, and investment and financing institutions is to be developed and standardized.

4. Bases for scientific and technological achievement industrialization are to be built. Focusing on emerging industrial fields such as ultra-high-speed wireless LAN, quantum communication, precision medicine, high-end medical equipment, graphene, thermal superconducting materials, drone technology, marine equipment manufacturing, energy saving and environmental protection, etc., a number of scientific and technological achievement industrialization bases are to be constructed. Services such as research and development, design, testing and certification, intellectual property rights, investment and financing, technology dissemination and demonstration, etc., are to be implemented.

5. Scientific and technological societies are to play a role in promoting the transfer and transformation of scientific and technological achievements. The full implementation of projects such as the Qianhui Wanqi JinqiaoProject⁹⁷ and the Guangdong version of the Haizhi Plan⁹⁸, enhancing the ability and level of academic societies and associations to contribute to the transfer and transformation of scientific and technological achievements, is to be ensured.

6. Enhance the functions of various platforms such as technology property rights transactions and intellectual property rights transactions, promoting effective integration between scientific and technological achievements and capital. Technology transfer organizations with required conditions are to be supported in establishing investment funds in cooperation with angel investors and venture capital, expanding investment for projects transforming scientific and technological achievements.

7. The Internet + Intellectual Property Rights plan is to be implemented, a big data application platform for intellectual property rights is to be built, and basic information such as patents, trademarks, copyrights, integrated circuit layout designs, and new plant varieties is to be opened up for free or at a low cost, promoting interoperability, cooperation, and sharing.

- 97 千会万企金橋 Project ("千会万企金桥工程"): A project that effectively provides information, improves the flow of channels, builds platforms, and allows experts and scholars to face society and the market, engage enterprises, and implement projects on achievement transformation, scientific and technological activities, and project cooperation.
- ⁹⁸ 海智 Plan: A strategy to develop the country through science and education and strengthen the country with talents, initiated in 2003 by the China Association for Science and Technology and 35 overseas scientific and technological organizations, aimed at organizing and attracting overseas scientists and technologists to contribute to the country in a variety of ways.

"Guangdong Province's 13th Five-Year Plan for the Development of Strategic Emerging
Industries" ("广东省战略性新兴产业发展" 十三五"规划")
(Guangdong Provincial People's Government Office, August 17, 2017)

1. The construction of a new emerging industry technology innovation system centered on the industry chain and integrating the innovation chain, with enterprises as the main body, and linking government, industry, academia, research, and users, is to be promoted, to enhance the innovation capacity of strategic emerging industries. The incubator multiplication plan is to be implemented, the construction of the incubation chain of Group Innovation Space + Incubator + Accelerator is to be accelerated, and the transformation rate of scientific and technological innovation achievements and the graduation rate of incubated companies by incubators are to be improved.

2. The mechanism for the transformation of scientific and technological achievements is to be improved. The attribution and profit distribution mechanisms of scientific and technological achievements and intellectual property rights are to be improved, the establishment of new management models in line with the characteristics and principles of transformation of scientific and technological achievements are to be explored, and a path for the transformation of scientific and technological achievements into actual productive forces is to be paved.

3. The active undertaking and incubation of science and technology projects in emerging industries from Hong Kong and Macao are to be pursued, and cooperation between Guangdong, Hong Kong, and Macao in building platforms for the transformation of scientific and technological achievements and international technology transfer is to be promoted.

4. Policy-based financial instruments and market principles are to be actively utilized, with fiscal funds playing a leading role. Investment and financing methods are to be innovated, investment in the development of emerging industries from multiple aspects is to be increased, and the innovation process of new industries is to be comprehensively covered.

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1. The construction of an international science and technology innovation center is to be promoted in the Greater Bay Area of Guangdong, Hong Kong, and Macao. Universities, research and development institutions, and enterprises in the province are supported in establishing offshore science and technology incubation bases or research and development institutions in countries along the Belt and Road.

2. A "last mile" for the transformation of scientific and technological achievements is to be pioneered. A mechanism to continuously support national major science and technology projects is to be established, attracting many national-level projects, and implementing expanded research and industrial application in Guangdong Province.

3. To enhance the enthusiasm for the transformation of scientific and technological achievements, asset management companies established by universities are allowed to invest in the scientific and technological achievements entrusted or transferred by the university using their own valuation. Equity incentives for scientific and technological personnel are to be implemented, and universities are allowed to independently approve the distribution and withdrawal of income from state-owned shares held by enterprises, with a portion of the income being retained by enterprises for their use. Universities and research and development institutions are allowed to retain the net profits from technological development, technical consulting, and technical services as income from the transformation of scientific and technological achievements, as well as retain them for independent usage.

4. A pilot reform of the ownership of scientific and technological achievements is to be conducted, allowing universities and research and development institutions to determine that the rights to the results of horizontal projects acquired through market commission belong to scientific and technological personnel. For new scientific and technological achievements formed using financial funds, universities and research and development institutions, together with scientific and technological personnel, can jointly apply for intellectual property rights based on the principle of facilitating the efficiency of the transformation of achievements, and grant ownership of the results.

5. To support the establishment of professional technology transfer organizations, the provincial finance office is to provide subsidies based on a certain percentage of the transaction value of registered technology contracts (excluding related transactions) concluded between universities, research and development institutions, and enterprises in the previous year, and the transaction value of technology introduced from overseas, focusing on the recruitment and cultivation of technology brokers or performance expenses related to employees.

6. The comprehensive integration of science and technology finance is to be promoted. A mechanism to match the funding needs of enterprises' innovation with information from financial institutions and venture capital is to be built, and information on the funding needs of high-tech companies, science and technology-type small and medium-sized enterprises, and companies undertaking research and development projects in the province's key areas is to be opened to financial institutions and venture capital

Regulation Name	"Regulations on Promoting Independent Innovation in Guangdong Province" ("广东省自主创
(Issuing Department and	新促进条例")
Implementation Date)	(Guangdong Provincial People's Congress, September 25, 2019)

1. All levels of people's governments shall protect the business model innovation activities of enterprises and business organizations based on law, formulate encouragement and support policies, support internet innovation, the integration of innovation systems and innovation concepts with industrial development, promote technological and business model innovation, and nurture new growth points in emerging industries and sectors.

2. The provincial people's government shall regularly publish guidelines on key areas of industrialization of independent innovation technologies and prioritize support for the transformation and industrialization activities of independent innovation achievements in high-tech industries, advanced manufacturing, modern service industries, and strategic emerging industries. People's governments at the county level and above and relevant departments with jurisdiction shall support the development of Science and Technology Intermediary Agents while strengthening supervision, management, and services. More specialized and technical jobs, such as the implementation of support policies, can be entrusted to qualified Science and Technology Intermediary Agents.

3. Science and Technology Intermediary Agents must provide research and development services, intellectual property services, technical testing, creative design, technical brokering, science and technology training, science and technology consulting and evaluation, venture capital, science and technology business incubation, technology transfer and dissemination, and other science and technology intermediary services to enterprises, universities, and research and development institutions, and must promote the transformation and industrialization of independent innovation achievements.

4. Financial institutions are to be encouraged and supported to provide financial innovation services such as intellectual property rights secured financing, insurance, venture capital, securitization, and trusts. Qualified financial institutions may implement science and technology credit services based on law and develop a service model of investment and financing linkage. Insurance institutions may develop various insurance products based on the needs of the transformation and industrialization of independent innovation achievements. Science and technology-type companies are to be encouraged and supported in fundraising through stock trading, issuing shares and bonds, etc.

Regulation Name	"Decision on Deepening the Reform of the Science and Technology System to Accelerate
(Issuing Department and	Innovation-Driven Development" ("关于全面深化科技体制改革加快创新驱动发展的决定")
Implementation Date)	(Guangdong Provincial People's Government, October 18, 2019)

Main Content

1. The decisive role of the market in the allocation of innovation resources is to be fully leveraged. The relationship between the government, enterprises, and the market is to be further rationalized, and policies and regulatory systems related to market competition, intellectual property rights protection, government procurement, and environmental regulation are to be improved.

2. Priority support for the establishment of comprehensive pre-incubators and large-scale incubators for small and micro enterprises is to be provided, and a networked innovation service system is to be built. The introduction of foreign capital and private capital in the establishment of state-owned incubators is to be actively pursued, and the development of a number of mixed-ownership incubators is to be explored.

3. The entry conditions for foreign capital and private capital in the science and technology service industry are to be eased, and cooperation with Hong Kong and Macao and international science and technology services is to be deepened. The development of science and technology service industries such as research and development design, cultural creation, technology trade, science and technology finance, science and technology service industry service outsourcing, science and technology consulting, etc., is to be vigorously pursued, and the construction of science and technology service industry clusters is to be promoted.

4. The construction of new types of technology transaction service platforms by private capital is to be supported, the merger, reorganization, and adjustments to optimize Science and Technology Intermediary Agents are to be supported, and the technology intermediary service system is to be improved. The creation of national technology transfer clusters is to be actively pursued, the construction of the Southern National Technology Transfer Center in Shenzhen is to be supported, national technology transfer demonstration institutions are to be cultivated, and the technology transfer and transaction service system is to be improved. Cities such as Guangzhou, Shenzhen, and Foshan are to be supported in standardizing the development of regional transaction markets and establishing a sound technology property rights transaction market.

Regulation Name	"Guangdong Province Science and Technology Business Incubation Carrier Management
(Issuing Department and	Measures" ("广东省科技企业孵化载体管理办法")
Implementation Date)	(Guangdong Provincial Department of Science and Technology, May 6, 2020)

1. Incubation carriers refer to various forms of incubation carriers such as group innovation spaces, incubators, and accelerators, and play an important role in the incubation chain.

2. The incubation chain is centered on incubators, extending to the front and back ends of incubators, focusing on startups and teams at different development stages, providing full-process professional incubation services, steadily progressing from team incubation to business incubation and industrial incubation, and building an integrated incubation chain with group innovation spaces and incubators, and accelerators.

3. Incubators must have an open online service platform, provide a variety of online services such as investment and loan matching, technical consulting, etc., and have at least five actual service-providing institutions.

4. Incubators that can provide precise incubation services in subdivided industries, have a freely usable public service platform, and provide professional technical services such as research and development, testing and inspection, and small-scale pilot tests can be recognized and managed as specialized incubators. Specialized incubators must have at least 25 incubated companies, an average of at least 2 companies per 1000 square meters, at least 75% of the total number of incubated companies must be engaged in research and development and production in the same industry sector, and the incubator must have at least 10 graduated companies.

5. Incubation carriers that meet the certification criteria can be recognized as incubators in Guangdong, Hong Kong, and Macao, in addition to being international incubation carriers. International, Guangdong, Hong Kong, and Macao group innovation spaces are accredited by the provincial science and technology management authorities and integrated into the management of Guangdong's group innovation spaces as pilot organizations of the province's group innovation spaces. International, Guangdong, Hong Kong, and Macao incubators, and national-level incubators are integrated into the management of provincial-level incubators and enjoy relevant preferential policies according to national and Guangdong policies.

Regulation Name	"Guangdong Province Regulations on Promoting Scientific and Technological Progress" ("广东
(Issuing Department and	省促进科学技术进步条例")
Implementation Date)	(Guangdong Provincial People's Congress, November 27, 2020)

Main Content

1. Provincial and municipal people's governments must emphasize research, development, and application of science and technology, accelerate the transformation of scientific and technological achievements into real productive forces, and their widespread application and dissemination in economic construction and social development.

2. Technical dissemination service organizations and various organizations providing pre-production, mid-production, and post-production services for agricultural production are exempt from income tax on income derived from technical or labor services, in accordance with national regulations.

3. Income derived from the transfer of technological achievements, technical training, technical consulting, technical services, technical contracting, technical design, and testing / analysis by research institutions and universities is exempt from income tax and business tax, in accordance with national regulations. Other enterprises and business organizations that provide technical services and have an annual net profit of 300,000 yuan or less, as well as newly established enterprises and organizations specializing in technical services, are exempt from income tax, in accordance with national regulations.

4. Technical trade institutions and individual laborers cannot engage in technology intermediation or technology brokerage activities without business registration.

Regulation Name	"Guangdong Science and Technology Innovation '14th Five-Year' Plan" ("广东省科技创新"
(Issuing Department and	十四五"规划")
Implementation Date)	(Guangdong Provincial People's Government, September 22, 2021)

1. With the core focus on the improvement of incubation capacity and acceleration of industrial incubation, the development of distinctive incubators centered around the National Technology Innovation Center in the Guangdong-Hong Kong-Macao Greater Bay Area is to be pursued, aiming to achieve a 1:1 ratio of entrepreneurship mentors to incubated companies in average incubators by 2025. In addition, the average incubator is to aim to have 6 graduated companies per year.

2. The construction of a national scientific and technological achievements transfer and transformation demonstration zone in the Pearl River Delta is to be promoted, the South China Technology Transfer Center is to be supported as an international and comprehensive high-end platform for technology transfer, and numerous technology transaction platforms integrating online and offline are to be built.

3. The construction of service platforms such as Productivity Promotion Centers, evaluation organizations, science and technology information centers, and legal service organizations for intellectual property rights is to be accelerated, and a sound science and technology service system for technology innovation, industrial design, cultural creation, quality inspection, intellectual property rights, information networks, market-oriented evaluation, e-commerce, entrepreneurship and incubation, entrepreneurial financing, personnel training, and safe production technology services is to be built.

4. The construction of a technology contract accreditation and registration system is to be strengthened, policies to support the construction of a technology transfer system are to be developed and formulated, specialized and high-level technology transfer organizations and technology manager teams with outstanding service capabilities are to be cultivated, a notification system for technology transfer organizations and technology managers is to be implemented, and professional title evaluations for technology transfer personnel are to be conducted.

Regulation Name	"Special Project Action Plan for the High-Quality Development of the Science and Technology
(Issuing Department and	Incubation Cultivation System in Guangdong Province (2021-2025)"
Implementation Date)	(Guangdong Provincial Department of Science and Technology, December 3, 2021)

Main Content

1. A supply chain collaborative innovation model led by leading companies is to be constructed. The dissemination of specialized incubators to accelerate industrial incubation is to be promoted. Industrial incubation clusters that align with regional industrial directions are to be cultivated.

2. In addition to Hong Kong, Macao, and Taiwan, international incubators are to be cultivated. The incubation service capacity of incubation platforms such as international incubators and overseas student entrepreneurship parks in addition to Hong Kong, Macao, and Taiwan is to be enhanced, overseas expansion through incubators' overseas operations is to be encouraged, and priority is to be given to offshore science and technology incubation bases or scientific and technological achievements transfer and transformation demonstration institutions established in Guangdong's international sister cities, international innovation talent clusters, and countries along the Belt and Road.

3. Science and technology innovation carriers and platforms are to be encouraged to establish specialized incubators. The deployment of numerous accelerators in high-tech zones is to be promoted. Specialized incubation chains to nurture emerging forces in regional industries are to be steadily built. By 2025, full coverage of provincial-level accelerators in national high-tech parks is to be achieved.

4. The integration of entrepreneurship incubation and science and technology finance is to be promoted. The linkage function between incubation and the capital market is to be strengthened. The further promotion of listings on the Beijing Trading Center, STAR market, stock market for venture growth companies, main stock exchanges, and overseas capital markets is to be pursued

Regulation Name	"Action Plan for the Market-Oriented Allocation Reform of Technical Factors in Guangdong
(Issuing Department and	Province" ("广东省技术要素市场化配置改革行动方案")
Implementation Date)	(Guangdong Province Department of Science and Technology, November 14, 2022)

1. The experimental field of technology innovation center reform in the Guangdong-Hong Kong-Macao Greater Bay Area is to be deeply cultivated, creating breakthroughs via reform and innovation of the system mechanism. The industrialization of technological achievements is also to be accelerated. A high-level technology transfer service system is to be constructed, strengthening the construction of leading core technology transfer organizations such as the South China (Guangzhou) Technology Transfer Center and Guangdong University Science and Technology Achievement Transformation Center. A system for specialized and graded technology transfer personnel training is to be built, and professional title evaluations for technology personnel working in technology brokerage are to be conducted. The comprehensive information public service platform for intellectual property rights resources is to be optimized using Internet+, supporting Guangzhou, Shenzhen, and Dongguan to build a sound intellectual property rights operation service system.

2. A national comprehensive service platform that connects the science and technology market and the capital market based on the Shenzhen Stock Exchange is to be built, and the market-based pricing and transaction mechanisms for scientific and technological achievements and intellectual property rights are to be improved. Venture capital is to be vigorously developed, constructing a risk-sharing and profit-sharing mechanism between government capital and social capital. The mechanism for science and technology credit provision is to be optimized, establishing a linkage mechanism between science and technology grants, science and technology credit provision, and venture capital. The financialization reform of intellectual property rights is to be accelerated, orderly implementing the securitization of intellectual property rights.

3. New models of international cooperation in science and technology innovation are to be explored, strengthening scientific and technological exchanges and cooperation with innovation-type countries and countries along the Belt and Road, establishing international science and technology cooperation bases in China with overseas innovation entities, supporting provincial companies to set up overseas research and development institutions, and implementing pilot projects to promote the cross-border flow of innovation factors.

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