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China's Science and Technology Innovation Policies

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Executive Summary

This report provides an overview of major science and technology innovation (STI) policies implemented in China since 2000, with a particular focus on those implemented under the Xi Jinping administration.

Chapter 1: Evolution of Science and Technology Innovation Policy

China's STI policy has been deeply rooted in its national development strategy since the founding of the People's Republic. From socialist construction to enhancing global competitiveness in the modern era, STI has consistently been positioned as a central pillar of national development. This evolution can be broadly divided into six stages.

From 1949 to 1977, under a Soviet-style planned economy, a centrally directed research system was established, emphasizing military and basic research. During the reform and opening-up period that began in 1978, China adopted the principle that "science and technology are the primary productive forces," focusing on introducing foreign technology and expanding applied research. In 1995, the "Strategy of Rejuvenating the Nation through Science and Education" was launched to enhance national competitiveness by integrating education with STI.

Entering the 2000s, the focus shifted to strengthening indigenous innovation capabilities. Following accession to the WTO, China placed greater emphasis on strengthening domestic technological capabilities amid intensifying international competition. After Xi Jinping took office in 2012, the Innovation-Driven Development Strategy was designated as a core national policy, driving policies aimed at transforming the economic structure. Since 2018, amid shifts in the international environment—such as U.S.-China tensions—the goal of becoming a technologically self-reliant and globally competitive nation has become paramount, with policies focusing on overcoming technological bottlenecks and domesticating core technologies.

Chapter 2: Major Science and Technology Innovation Policies

Against this historical backdrop, China has formulated several medium- and long-term STI policy documents, further refining its policy framework. The National Medium- and Long-Term Plan for Science and Technology Development (2006–2020), announced in 2006, was the first comprehensive plan outlining national priority technology areas and policy directions for funding, talent development, and institutional support. In 2016, the Outline of the National Innovation-Driven Development Strategy (2016–2030) was released to guide China's transition to a knowledge-based economy, positioning innovation as a new engine of growth. Most recently, in 2024, the Further Deepening Reform Comprehensively to Advance Chinese Modernization was introduced to rationalize research funding allocation, reform commercialization mechanisms, and strengthen the authority of research institutions.

Chapter 3: Funding Allocation Policy

Since 2014, reforms have been introduced in phases to reduce inefficiencies and fragmentation in research funding. Beginning in 2015, key initiatives included consolidating national research programs and introducing performance-based evaluations. In 2021, the government adopted a more flexible approach to executing central science and research budgets, granting greater autonomy to research institutions.

Chapter 4: Talent Policy

A wide range of programs have been introduced to attract and develop both domestic and overseas high-level talent. The Thousand Talents Program, launched in 2008, focused on attracting overseas Chinese researchers. The National Medium- and Long-Term Talent Development Plan, announced in 2010, promoted institutional reforms in education, employment, and compensation. More recently, in response to the rise of the digital economy, the Action Plan to Accelerate Digital Talent Development was released in 2024.

Chapter 5: Basic Research

China has shifted away from an overemphasis on applied research, placing greater importance on strengthening foundational research with a long-term outlook. The "Guidelines for activities to strengthen basic research and achieve 0 to 1" advocated for increased researcher autonomy and targeted investments in key scientific areas. The 2024 government work report also pledged to expand financial support for basic research and increase its share of overall funding.

Chapter 6: Policy for Commercialization of Scientific and Technological Achievements

This chapter highlights major institutional reforms aimed at facilitating the practical application of research outcomes. Following the 2015 revision of the Law of the People's Republic of China on Promoting the Transformation of Scientific and Technological Achievements, universities and research institutes were strongly encouraged to transfer technologies, launch spin-offs, and utilize intellectual property. In 2024, the Decision on Deepening Comprehensive Reform introduced mechanisms linking researcher evaluation and promotion systems to commercialization outcomes, further incentivizing the practical application of research.

Chapter 7: Industrial Policy

This chapter highlights national strategies such as Made in China 2025, which emphasize high-end manufacturing and the development of key sectors like AI, robotics, and aerospace. In recent years, industrial policy has been increasingly integrated with R&D initiatives to foster emerging industries of the future.

Chapter 8: Policies for Enhancing National Competitiveness

China is also leveraging STI to strengthen its international presence. Through initiatives such as scientific cooperation under the Belt and Road framework and the 2018 Plan for Leading International Mega Science Projects and Programs, China is enhancing its technological visibility in global governance. Additionally, the country is actively constructing a new form of soft power that merges STI with diplomacy, using conceptual frameworks such as the Philosophy of Building a Community with a Shared Future for Mankind.

Chapter 9: Scientific and Technological Innovation Achievements and Challenges as Reflected in Policy Documents

This chapter introduces the major achievements and ongoing challenges in China's STI landscape, as documented in various official policy statements, including a compilation of accomplishments published by the National Bureau of Statistics of China in celebration of the 75th anniversary of the founding of the People's Republic.

China's STI policy, while fundamentally rooted in a state-led, planned economic model, is undergoing dynamic transformation as it seeks alignment with market mechanisms and market-oriented institutional reforms. The policy framework consists of a multilayered structure, including long-term strategies, sectoral initiatives, and reforms in funding, talent development, and institutional arrangements. These policies are closely tied to broader national goals such as economic security and global leadership. Looking ahead, critical attention will be focused on how effectively these policies align with international standards—and whether China can secure a competitive edge in the global technology race.

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1. Evolution of Science and Technology Innovation Policy

In 1949, the Communist Party of China (CPC) emerged victorious in the civil war against the Chinese Nationalist Party (Kuomintang–KMT) and established the "New China." Over the next 75 years, advances in science and technology have remained a paramount strategic priority in China. Consequently, since the founding of New China, critical policy decisions have been made at historical milestones, and science and technology have developed in response. In this section, we divide these 75 years into six stages and explain the basic science and technology policies for each.

1.1 Marching Toward Science (1949–1977)

With the establishment of the New China in 1949, supporting, guiding, and coordinating the development of science and technology through science and technology policies became a key strategic priority for the Chinese government. At the "Conference on Intellectual Issues" held in January 1956, Premier Zhou Enlai emphasized that "in the socialist era, comprehensive development of science and technology and the application of scientific knowledge are needed more than ever before. Science and technology are decisive factors in national security, economic development, and social and cultural advancements." Chairman Mao Zedong also called upon the entire nation to "march toward science," expressing strong commitment to promoting science and technology by stating that "we will strive to bring our country's economic, scientific, and cultural levels up to those of modern nations within a few decades." Under these guiding principles, **China's first national science and technology plan** was made public in 1956. The **nation's first medium- to long-term science and technology plan, the "Outline of the Long-term Plan for the Development of Science and Technology from 1956 to 1967,"** was also released. This master plan proposed 12 priority areas, including the "Two Bombs, One Satellite" strategy, and laid out rules for the national research and development system, human resource utilization policies, and the establishment of institutions. This master plan subsequently led to the formulation of the "**Ten-Year Science and Technology Development Plan**" in 1963, which considered the evolving science and technology landscape in China and worldwide.

The situation changed dramatically from a favorable development with the onset of the Cultural Revolution in 1966. The Cultural Revolution has severely affected China's development of science, technology, and innovation. Research institutions, including the Chinese Academy of Sciences, were no longer able to conduct normal R&D activities due to ideological struggles and the expulsion of researchers for ideological reform, leading to repeated reorganizations and a slowdown in hiring new staff. Universities faced similar challenges: classrooms, laboratories, and other facilities were repeatedly destroyed, and university entrance examinations were canceled, leading to a halt in student enrollment.

1.2 Science and Technology as the Primary Productive Force (1977–1995)

In March 1978, immediately after the conclusion of the Cultural Revolution, the National Science Conference held by the Central Committee of the Communist Party of China emphasized that "**the key to the four modernizations is the modernization of science and technology, and science and technology constitutes the primary productive force.**" This National Science Conference adopted the "Outline of the National Plan for the Development of Science and Technology (1978–1985) (Draft)." Subsequently, a series of key policies were announced and implemented, including the "Regulations on Awards for Inventions (1978)," the "Outline Report on Policy concerning the Development of our National Science and Technology (1981)," and the "Resolution of the Central Committee of the Communist Party of China on the Structural Reform of the Science and Technology System (1985)." The "National Medium- and Long-Term Program for Science and Technology Development" of 1985 was the first medium- to long-term strategy formulated by China to position science and technology as the driving force for economic development, to promote system reform, and to strengthen research and development. This program promoted research-industry collaboration and concentrated resources in priority sectors, including information technology, biotechnology, new materials, and energy, while carrying out reviews of human resource development and funding allocation. It served as a crucial policy turning point that laid the foundation for subsequent initiatives, such as the "National High-tech R&D Program (863 Program)" and the "National Key Basic Research Development Program (Program 973). "The Resolution of the Central Committee of the Communist Party of China on the Structural Reform of the Science and Technology System (1985)" was an important policy designed to restructure existing science and technology mechanisms and make a new start. They stated that it is necessary to change the operational mechanisms of science and technology activities, adjust the organizational structure of the science and technology promotion system, and review personnel management systems for scientific and technical professionals. It also guided the strategic direction of future science and technology policy, stating that "economic construction must rely on science and technology, while scientific and technological work must be oriented toward contributing to economic construction."

Numerous policies that served as the foundation for science and technology development were enacted during this period, including the "Technology Contract Law of the People's Republic of China (1986), Several Provisions of the State Council of the People's Republic of China on Further Promoting Science and Technology System Reform (1987), Decision of the State Council on Issues Concerning Further Deepening Science and Technology System Reform (1988), China's ten-year science and technology development plan, and outline of the 'Eighth Five-Year' Plan (1991-2000)," the Law of the People's Republic of China on Progress of Science and Technology (1993)," among others.

Notably, large-scale programs were implemented during this period. These are evaluated as having made significant contributions to the development of China's science and technology and its economy.

Large-scale Programs:

1) "National High-Tech Research and Development Program (863 Program)" (1986)
Intending to catch up with Western science and technology, in March 1986, academicians from the Chinese Academy of Sciences, Wang Daheng, Wang Ganchang, Yang Jiachi, and Chen Fangyun, jointly submitted a "proposal on follow-up study of foreign strategic high-tech development" to Deng Xiaoping. In response to this proposal, Deng Xiaoping directed the State Council to take immediate action, launching the "State High-Tech Development Plan." Numerous scientific and technological projects were implemented across priority sectors, including biotechnology, aerospace, ICT, laser, automation, new materials, and marine technology. By 2001, approximately 5,200 projects in 230 research themes had been supported, with more than 2,000 patents granted and more than 47,000 papers published. One of the most notable achievements is the establishment of the National CIMS Engineering Center at Tsinghua University, which served as a technology bridge in the automation sector, transferring technology to more than 50 factories across machinery, electronics, aviation, and other industries, significantly reducing manufacturing costs and shortening production cycles.
2) "Torch Program" (1988)
The "Torch Program" is an initiative launched by the Ministry of Science and Technology of the People's Republic of China in August 1988 to establish national-level high-tech industrial development zones throughout China, promoting the commercialization, industrialization, and internationalization of scientific and technological research achievements. The program was designed to develop advanced technologies and high-tech products with domestic and international market potential and economic effectiveness, establish high-tech industrial development zones nationwide, and explore management systems and operational mechanisms suited to high-tech industry development. In May 1988, the State Council established the first national high-tech park, the "Beijing New Technology Industrial Development Pilot Zone," based on Beijing's Zhongguancun Electronics Street. According to announcements from the Ministry of Industry and Information Technology, 178 national high-tech parks had been established nationwide by the end of 2023.
3) "Spark Program" (1986)
In December 1978, under the leadership of Deng Xiaoping, the Chinese Communist Party submitted a basic policy to the Third Plenary Session of the 11th Central Committee to reform the domestic system, open to the outside world, reflect on the mistakes of the Cultural Revolution, and promote economic development. In response to this policy, domestic reforms were implemented in rural areas of China during the 1980s. People's communes were successively dismantled, and rural enterprises ("township and village enterprises" in Chinese) rapidly increased. As a result, there was a shortage of agricultural technical personnel, and improving the productivity of rural technology became an urgent priority. Against this backdrop, the Chinese State Council launched the "Spark Program" in 1986 to improve rural technology and accelerate urbanization. The Spark Program was designed as an overall system by the central government and implemented by each province, municipality, and autonomous region according to their respective circumstances. The Spark Program, dedicated to improving rural technology and supporting rural enterprises, has made significant contributions to revitalizing rural areas.

1.3 Strategy of Invigorating China Through Science and Education (1995–2003)

In 1995, the National Science and Technology Conference was held, during which the "**Decision of the Central Committee of the Chinese Communist Party and the State Council on Accelerating Scientific and Technological Progress**" was announced. At this conference, the "Strategy of Invigorating China through Science and Education" was proposed. The essence of this strategy was "to place science, technology, and education in prominent positions in socioeconomic development, drive economic growth through scientific and technological advancement, enhance workforce capabilities, and continuously promote reforms in science and technology systems. This strategy aims to guide higher education institutions to fulfill their essential roles within the national innovation system." In other words, the importance of education, science, and technology for overall societal development has been greatly emphasized.

Under the strategy of Invigorating China through Science and Education, the "**Project 211**" and "**Project 985**" were launched to build world-class universities and academic disciplines. Many of the science and technology policies issued during this period focused on strengthening university capabilities and promoting their outputs, with representative examples including the "Law on Promoting the Transformation of Scientific and Technological Achievements (1996)," "Establishment of National Innovation System in New Era of Knowledge Economy (1997)," and "Several Provisions on the Transformation of Scientific and Technological Achievements (1999)."

In 1999, the government issued the "**Decision on the Realization of Innovation, High-Tech Development, and Industrialization,**" which promoted the further deepening of science and technology system reform. In the same year, the State Council issued the "Regulation on National Science and Technology Awards," which further encouraged incentives for innovation among research institutions and researchers.

Subsequently, the "Implementation Opinions on Deepening Reform of the Management System of Scientific Research Institutions" issued in 2000 provided comprehensive policy support from various aspects, including state-owned assets, tax revenues, and employee pensions.

In 2001, China joined the World Trade Organization (WTO), necessitating alignment of its scientific and technological innovation policies with the WTO framework. Consequently, adjustments have been made to policies on R&D subsidies, investment, taxation, and intellectual property.

1.4 Enhancing China's Indigenous Innovation Capabilities (2003–2012)

After approximately 30 years of rapid development following the reform and opening-up policy, China has grown into a major economic power attracting global attention. While the economy has achieved growth, challenges remain, including talent shortages (particularly among high-level professionals) and a lack of indigenous innovation capabilities. Furthermore, the establishment of social institutions and laws has lagged behind rapid economic growth, leading to a series of contradictions and problems.

The Third Plenary Session of the Chinese Communist Party's Central Committee, held in October 2003, adopted the "Decision of the Central Committee of the Communist Party of China on Some Issues concerning the Improvement of the Socialist Market Economy" and further advanced systemic reforms in areas such as fiscal and taxation revenue, finance, and investment.

In 2006, the "**Outline of the National Medium- and Long-Term Program for Science and Technology Development (2006-2020)**" was published, which set out the goals and plans for scientific and technological development over the subsequent 15 years, with the primary objective of building an innovation-driven nation centered on improving indigenous innovation capabilities. In March 2006, as the implementation plan for the first five years of this outline, the "11th Five-Year Plan for National Science and Technology (2006–2010)" was released by the State Council, followed by the "12th Five-Year Plan for National Science and Technology (2011–2015)" in July 2011.

In 2007, the conventional "**Science and Technology Progress Law**" was amended to strengthen scientific and technological activities, and the government was legally obligated to invest in science and technology at a level exceeding China's economic growth.

In September 2012, the Central Committee of the Communist Party of China and the State Council published the **"Opinion on Deepening Reform of the Science and Technology System and Accelerating Construction of the National Innovation System,"** declaring their commitment to accelerate the construction of the national innovation system by deepening science and technology system reforms and fully leveraging the role of science and technology in economic and social development. In accordance with these opinions, various State Council departments issued more than 200 policy documents and advanced reforms, including reforms in planning and management, the academic system, and the science and technology award system, as well as the formulation, implementation, and supervision of scientific and technological innovation policies in the new era.

1.5 Innovation-Driven Development Strategy (2012–2020)

The Xi Jinping administration began in 2013. China's economy slowed from a growth rate of approximately 10% to 7%, entering the **"New Normal" economic era**, characterized by a transition from high growth to medium-to-high growth. To drive the industrial structural transformation and successfully ride the wave of the new industrial revolution, the government designated "scientific and technological innovation" as the driving force behind the comprehensive construction of a modern socialist nation. In 2015, "Some Opinions Concerning Deepening Structural and Mechanism Reform and Accelerating the Implementation of the Innovation-Driven Development Strategy" and "Some Opinions on Vigorously Promoting Mass Entrepreneurship and Innovation" were successively released to lay the groundwork for "comprehensive innovation." The "Implementation Plan for Deepening Science and Technology System Reform released in the same year proposed 32 reform measures and 143 policy measures across ten fields, including strengthening the leading role of enterprises in innovation, promoting the innovation vitality of scientific research and higher education institutions, reforming human resource evaluation and incentive mechanisms, and promoting the transformation of scientific and technological achievements, aiming to build an innovation system with Chinese characteristics.

In May 2016, the Central Committee of the Communist Party of China and the State Council issued the **"National Innovation-Driven Development Strategy Outline (2016–2030)".** At the National Scientific and Technological Innovation Conference held that month, Xi Jinping put forward the "Three-Step" strategic goal for China's scientific and technological development, declaring that China would build a global science and technology powerhouse by 2050 while simultaneously achieving socialist modernization. In the same year, the "13th Five-Year Plan for National Science and Technology Innovation (2016–2020)" was released.

1.6 Building Science and Technology Powerhouse Through Self-Reliance and Self-Strength (2020 to present)

The year 2021 was a landmark year, marking the 100th anniversary of the founding of the Communist Party of China; on this occasion, new goals were proposed.

First, the "**Outline of the 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives for 2035,**" published in March, put forward the long-term objectives for implementing incubation and acceleration programs for future industries and planning and deploying various future industries in the fields of cutting-edge science and technology and industrial transformation, including brain-inspired intelligence, quantum information, genetic technology, future networks, deep-sea/aerospace/space development, hydrogen energy, and energy storage.

At the celebration commemorating the 100th anniversary of the founding of the Communist Party of China held in July, Xi Jinping expressed confidence that "one of the '**Two Centenary Goals**'—the comprehensive establishment of a moderately prosperous society—has been achieved, and the issue of absolute poverty has been resolved. He further expressed full confidence that the other "Centenary Goal," namely, "completing the building of a great modern socialist country by 2049, the 100th anniversary of the founding of China, will certainly be achieved." He also stated that China would promote the construction of a new type of international relationship and work together to promote high-quality development of the "Belt and Road" Initiative, while maintaining mutual benefit and win-win cooperation, avoiding zero-sum games, and opposing hegemony and authoritarian politics.

At the 20th National Congress of the Communist Party of China in October 2022, Xi Jinping emphasized the need to build a modern industrial system while advancing the development of Digital China and stressed the importance of developing a scientific and technological innovation system with science and technology as the primary productive force, workforce as the primary resource, and innovation as the primary driving force to achieve early realization of high-level scientific and technological self-reliance and self-strength.

In September 2023, Xi first introduced the concept of "**new quality productive forces**" during his inspection tour of Heilongjiang Province, which emerged as a keyword for economic and social development. New quality productive forces are characterized by high technology, high efficiency, and high quality, with innovation as their primary characteristic, high quality as their key, and advanced productive forces as their essence. Specifically, they refer to modern advanced productive forces generated through revolutionary technological breakthroughs, innovative allocation of production factors, and deep-level industrial transformation and upgrading. Their fundamental components encompass qualitative changes in laborers, means of labor, and objects of labor, along with their optimized combinations, with improvement in total factor productivity serving as the core indicator. China has continuously strengthened its scientific and technological capabilities since reform and opening-up to support industrial development and establish a solid foundation for the development of strategic emerging and future industries.

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2 Major Science and Technology Innovation Policies

Chapter 2 provides a detailed description of the key science and technology innovation policies since 2000, particularly under the Xi Jinping administration.

2.1 Outline of the National Medium- and Long-Term Program for Science and Technology Development (2006–2020)

In 2006, the State Council issued the "Outline of the National Medium- and Long-Term Program for Science and Technology Development (2006–2020)," which served as a long-term policy framework for science and technology innovation. The Outline set a goal of transforming China into an innovation-oriented nation with world-class scientific and technological capabilities by 2020, aiming to achieve this goal by expanding R&D investment and strengthening priority fields.

As presented in this outline, the goals for **science and technology development by 2020** include the following:

1) Provide strong support for the comprehensive construction of a "moderately prosperous society" through the remarkable improvement of economic and social development and national security capabilities through indigenous innovation capabilities, as well as science and technology (meaning that scientific and technological progress and indigenous innovation will greatly develop the economy and society while strengthening national security).
2) Lay the foundation for becoming a global science and technology powerhouse by the middle of this century by significantly improving comprehensive capabilities in basic science and cutting-edge technology research, achieving research results with global influence, and joining the ranks of innovation-oriented nations.
3) An increase in the proportion of national R&D investment in GDP to over 2.5% by 2020 will raise the contribution rate of scientific and technological progress (the proportion indicating how much scientific and technological progress contributes to economic and social development) to over 60%, lower the level of dependence on foreign technology to 30% or less, and ensure that both the annual number of patent registrations by domestic individuals and the citation count in international scientific papers rank among the top five in the world.

The **strategic priorities for future science and technology development** are as follows:

1) Prioritize the development of energy, water resources, and environmental protection technologies to solve critical bottlenecks that hinder economic and social development.
2) Seize the opportunity for a generational shift in information technology and the rapid evolution of new material technology in the next few years, and position the acquisition of independently developed

intellectual property rights in core technologies for the equipment manufacturing and information industries as a breakthrough to enhance China's industrial competitiveness.

3) Position biotechnology as a key focus for catching up with future cutting-edge technology industries and strengthening its applications in fields such as agriculture, industry, population, and health.
4) Accelerate the development of aerospace and marine technologies.
5) Strengthen research in basic science and cutting-edge technologies, particularly interdisciplinary research.

The new guiding principle of the Communist Party of China, the "Scientific Outlook on Development," introduced in 2007, is said to have emerged from the formulation process of this outline.

2.2 The 11th Five-Year Plan for National Science and Technology (2006–2010)

The 11th Five-Year Plan for National Science and Technology is the first five-year plan of the "Outline of the National Medium- and Long-Term Programs for Science and Technology Development (2006–2020)." The National People's Congress formally adopted this plan in March 2006 as a subordinate policy under the overarching national framework of the "11th Five-Year Plan for the National Economic and Social Development of China." The top priority of the 11th Five-Year Plan, in one word, is to build a **"harmonious society" based on the "scientific outlook on development."** The scientific outlook on development is an ideology that places people at the center, promoting comprehensive, coordinated, and sustainable development across the economy, politics, culture, and other areas. Under the conventional "letting some get rich first" policy, China's economy has continued to grow at a high rate of around 10%. However, this has led to increased income inequality, a risk factor for social unrest. China, which needed to maintain social stability by aiming for equalization of income distribution rather than merely pursuing the speed and scale of economic growth, shifted its policy direction from "letting some get rich first" to "common prosperity," in which all become prosperous together, and began emphasizing the construction of a "harmonious society." The term "harmonious society" refers to a society characterized by harmony (balance), encompassing factors such as harmony between urban and rural areas, harmony in the industrial structure, harmony across regions, harmony in income disparities, and harmony between the economy and the environment.

(1) Specific policy tasks related to the development of science and technology innovation

The Five-Year Plan includes the following tasks:

1) Promotion of indigenous innovation: Strengthen basic research, cutting-edge research, and research with high social and public benefits to enhance the potential in fields such as information, life sciences, space, oceans, nanotechnology, and new materials. Key projects should be launched, and key technologies strengthened.
2) Infrastructure development to achieve indigenous innovation: Construction of major scientific and technological research infrastructure.

3) Strengthen technological innovation in enterprises.
4) Protection of intellectual property rights.
5) Promotion of the strategy for building strong human resources.
6) Cultivation of human resources rich in innovation awareness and capability.

(2) Major scientific and technological achievements

1) R&D expenditure in 2010 reached 698 billion yuan, up 1.85 times from 2005, accounting for 1.75% of the GDP.
2) The number of researchers in terms of full-time equivalents (FTE) has grown at an average annual rate of 13%, reaching 2.55 million by 2010.
3) In 2010, the number of patent applications was 1.222 million. During the 11th Five-Year Plan period, China's invention patents ranked third in the world, with domestic invention patent applications growing at an average annual rate of 25.7% and the number of granted patents increasing at an average annual rate of 31%.
4) The total number of international scientific papers rose from 5th to 2nd globally, and the number of citations increased from 13th to 8th in the world.
5) Progress has been made and breakthroughs achieved in fields such as manned spacecraft (successful launches of the Shenzhou series), lunar exploration business (launch of Chang'e 2), supercomputers (Tianhe-1 becoming the world's number-one supercomputer), super hybrid rice (hybrid rice), high-speed rail, experimental fast reactors, quantum communication, iron-based superconductivity, manned deep-sea diving (Jiaolong submersible reaching a maximum depth of 4,981 meters), and induced pluripotent stem cells (iPS cells).
6) A total of 156 new national key laboratories were constructed, bringing the total number to 333. A total of 114 new national engineering research centers were established, bringing the total to 387. The number of new national engineering laboratories was 91, and the number of national enterprise technology centers increased to 575.

2.3 The 12th Five-Year Plan for National Science and Technology (2011–2015)

To accelerate the implementation of the "Outline of the *National Medium- and Long-Term Program for Science and Technology Development* (2006–2020), the State Council announced the "12th Five-Year Plan for Science and Technology (2011–2015)" was announced by the State Council in 2011. The most important issue during this period was the **transformation of the economic development methods.** Although the annual growth target of 7% was relatively low compared to previous years, it appears that there was an intention to improve the quality of economic growth by transforming economic development methods.

(1) Goals in the field of science and technology

In the field of science and technology, **based on the "invigorating China through science and education" strategy and the "talent powerhouse" strategy**, it is emphasized to promptly establish systems for basic research and cutting-edge technological research, promote major scientific discoveries and the emergence of new academic fields, secure a leading position in future science and technology competition in fields such as materials science, life science, space science, earth science, and nanotechnology, as well as to accelerate the establishment of a technology innovation system led primarily by enterprises. The goal is to produce world-class scientists, top professionals in science and technology, engineers, and high-level innovation teams by reforming the educational system and fostering students' scientific spirit, creative thinking, and innovation capabilities.

(2) Major scientific and technological achievements

During this period, China's innovation capabilities improved significantly, marking a new stage in its development as an innovation-driven nation. The main scientific and technological achievements of the 12th Five-Year Plan are as follows:

1) In 2014, R&D expenditure reached 1.3312 trillion-yuan, accounting for 2.09% of the GDP. Corporate R&D spending exceeded 77%.
2) China ranked second in the world in terms of the number of international scientific and technological papers, with the number of citations jumping from eighth in 2010 to fourth in 2015 in seven fields: agriculture, chemistry, and materials.
3) The number of patent applications in China increased from 1.109 million in 2010 to 2.639 million, ranking first worldwide, and the number of patents granted increased from 741,000 to1.597 million, ranking second in the world.
4) The global influence of basic research increased significantly. Major innovative achievements have been made in quantum communications, the quantum anomalous Hall effect, Weyl fermion research, neutrino oscillation, chemically induced pluripotent stem cells (CiPS cells), and iron-based high-temperature superconductivity. Tu Youyou received the 2015 Nobel Prize in Physiology or Medicine, and Wang Yifang won the 2016 Breakthrough Prize in Fundamental Physics. In addition, Pan Jianwei's research on multi-degree-of-freedom quantum teleportation ranked first among the top 10 world physics breakthroughs in 2015.
5) The number of national key laboratories reached 481, and national engineering research centers reached 346, and significant progress was made in the construction of large-scale scientific equipment, such as those for protein research, the 500-meter aperture spherical radio telescope, and the spallation neutron source, and the dark matter particle exploration satellite "Wukong" was successfully launched.

2.4 Military-Civil Fusion Development Strategy (2015 onwards)

The military-civil fusion strategy is a critical national strategy through which China aims to advance both national security and economic development.

In March 2015, the **"Military-Civil Fusion Development Strategy" was first announced** in the government activities report of the National People's Congress. The "fusion" in this strategy does not merely mean cooperation but refers to the establishment of a system for the integrated operation of the nation's entire resources. The strategy has evolved dramatically from "military-civil fusion" and "military-civil cooperation" to "in-depth fusion" since 2015.

(1) Background

In an era in which the military application of high-tech technologies determines the difference in military power, the Chinese government appears to have strongly recognized the need to strengthen the nation's comprehensive capabilities, given the escalating geopolitical risks around China, including the South China Sea issue, the Taiwanese situation, and the US-China confrontation. Indeed, since 2015, the Xi Jinping administration has decisively implemented large-scale organizational reforms of the People's Liberation Army and has institutionally introduced "military-civil fusion" as a pillar of reform to address military corruption and inefficiency and advance modernization.

This strategy aims to achieve two goals simultaneously: "a strong military and a strong economy" by promoting the military's high-tech development in collaboration with civilian technologies. However, it also faces the challenge that improvements in innovation capabilities are not always directly translated into enhanced military strength. In 2017, the **"Central Commission for Integrated Military and Civilian Development"** was established, with Xi Jinping appointed as chairman. In March of the same year, Xi Jinping explicitly stated at the National People's Congress that **"the fusion of all factors, all domains, and high efficiency should be promoted."** This step marked the institutionalization of the military-civil fusion strategy.

- **All factors**: Target all resources, including technology, equipment, human resources, funding, and information.
- **All domains**: Science and technology, education, industry, logistics, infrastructure, space, cyber, and maritime.
- **High efficiency**: Eliminates the time lag between military and civilian development and application, enabling rapid conversion and integration.

The military-civil fusion strategy has continued to accelerate in high-tech fields such as AI, space, and quantum. It has been incorporated into the 13th Five-Year Plan and "China Standards 2035."

(2) Three major goals of the strategy

Goals	Contents
Establishment of national strategic systems	Institutionalization of military-civil fusion across policies, systems, legal frameworks, technology, resources, and human resources.
Coordinated development of economic construction and national defense construction	Simultaneously advancing economic growth and strengthening national defense capabilities.
Advancement of mutual conversion of military and civilian resources	A system enabling the conversion of military technology to civilian use and civilian technology to military use (dual-use).

(3) Main contents

Field	Content
Technology Fusion	Participation of civilian technology enterprises in military R&D in fields such as AI, quantum, space, and biotechnology.
Institutional Fusion	Integrated management system for military and civilian resources, including unified standards, joint procurement, and patent sharing.
Organizational Fusion	Establishment of the " Central Commission for Integrated Military and Civilian Development," chaired by Xi Jinping.
Human Resources Fusion	Human resource exchange and joint training among the military, universities, and enterprises.
Regional Fusion	Military-civil fusion industrial parks centered in Xi'an, Changsha, and Chengdu.

(4) Evaluation

Xi Jinping's "military-civil fusion strategy" is not merely a military policy, but is positioned as a medium- to long-term strategy for transforming the national system itself into a "wartime-ready" system. It has the multifaceted objective of national integration of technological capabilities and synergies among the military, economy, and science, and pursues both security and economic growth. Its impact is expected to spread to the international community. Private companies are involved in military development and the procurement of equipment for the People's Liberation Army, serving as bridges for "military-commercial dual-use technology. Consequently, Western countries tend to consider these "private companies as part of the military." There are numerous military support players in China that "masquerading" as private companies, with their technological capabilities fully incorporated into the national strategy. This structure has become a factor in directly promoting the design and strengthening of economic and security policies in various countries, increasingly evolving from mere economic policies to national security policies. With this strategy in mind, the United States is strengthening its "entity list," "investment restrictions," and "export controls."

(Reference) Examples of private companies involved in the military-civil fusion strategy

Company Name	Field	Content
Huawei	Telecommunications, AI, 5G, cybersecurity	Construction of military-grade communication networks and military applications of 5G technology. Collaborative research with institutions such as the National University of Defense Technology.
SenseTime	Facial recognition, AI surveillance technology	Providing facial recognition systems and crowd monitoring technology to military and public security institutions.
Sugon	Supercomputers, cloud computing, and quantum computing	Development of high-performance computers for military simulations and ballistic calculations.
DJI (Da-Jiang)	Drones	The People's Liberation Army (PLA) repurposed proliferated civilian drones for reconnaissance and tactical applications.
Baidu	Autonomous driving and AI	Autonomous military vehicle project with the National University of Defense Technology.
ZTE	Communications and surveillance	Delivery of products to PLA-related facilities.
Hikvision	Surveillance cameras	System development for military and public security purposes.

Sources: Compiled based on various materials

2.5 Outline of the National Innovation-Driven Development Strategy (2016–2030)

China's ruling ideology is publicly announced every time the regime changes. Following the "Mao Zedong Thought" of the Mao Zedong administration, the "Deng Xiaoping Theory" of the Deng Xiaoping administration, the "Three Represents" of the Jiang Zemin administration, and the "Scientific Outlook on Development" of the Hu Jintao administration, the Xi Jinping administration has revealed its "Xi Jinping Thought," however, the ideology that runs throughout these ideologies is "Innovation-Driven Development." This policy is considered vital because it reflects China's ideal image under the Xi Jinping administration.

In May 2016, the innovation-driven development strategy submitted by the Communist Party of China at the 18th National Congress was a medium- to long-term strategy covering 15 years up to 2030, with a vision extending to 2050. This outline aims to elevate China to become a global powerhouse in science and technology innovation by the 100th anniversary of its founding to realize the Chinese dream by further strengthening investment in science and technology innovation in light of China's economic progress, science and technology development, and the growth of high-tech enterprises; it also serves as the foundation for various high-tech industry strategies introduced during this period.

The outline presents the goals to be achieved by 2050 in three steps.

- Step one: By 2020, join the ranks of innovation-driven nations, establish a national innovation system with Chinese characteristics, and build a moderately prosperous society.
- Step two: By 2030, take the lead among innovation-driven nations, achieve a fundamental transformation in development drivers, significantly raise the levels of economic and social development and international competitiveness, and lay a solid foundation for building an economically strong nation and a society with shared prosperity.

・Step three: By 2050, become a new global powerhouse in science and technology innovation, a global center of science and technology, and a leader in innovation; build a prosperous and strong, democratic, civilized, and harmonious socialist modernized nation; and ultimately realize the Chinese dream of the great rejuvenation of the Chinese nation.

In addition to the major national science and technology projects designated in the Outline of the *National Medium- and Long-Term Program for Science and Technology Development* (2006-2020) and the Five-Year Plans, the Outline announced the New **Science and Technology Innovation 2030 Major Projects,** which include: (1) aerospace engines and gas turbines, (2) quantum communications, (3) information networks, (4) smart manufacturing and robotics, (5) deep-space and deep-sea exploration, (6) key new materials and energy, (7) brain science, and (8) health and medical care.

Furthermore, as **priority areas for industrial technologies toward 2030**, the outline identifies the following: (1) next-generation ICT technologies, (2) smart and green manufacturing technologies, (3) advanced agricultural technologies, (4) advanced energy technologies, (5) technologies for efficient use of resources and environmental protection, (6) marine and space technologies, (7) smart city and digital society technology, (8) healthcare technologies, (9) advanced service technologies, and (10) industrial transformation technologies.

In addition to the promotion of science and technology, the following measures have been proposed to promote the growth of the local economy and upgrade the entire industry:

・**Strengthen originality in basic research**: To enable China to break away from technology imitation and cultivate its capability to pioneer global scientific and technological frontiers through its original intellectual contributions, this measure seeks to strengthen basic natural science fields (such as mathematics, physics, chemistry, and biology) and establish a system that supports free academic research from a long-term perspective.

・**Optimization of resource allocation by region**: This refers to strategic resource allocation based on each region's industrial structure and technological strength. For example, the eastern coastal regions focus on high-tech technologies and R&D, whereas the central, western, and northeastern regions promote foundational manufacturing and regional innovation. The objective is to improve the nation's overall technological capabilities and correct the economic disparities among regions.

・**Promotion of dual-use technology**: Dual-use technologies apply to both civilian and military purposes, and priority support is provided in areas such as artificial intelligence, quantum communications, space development, and robotics.

・**Strengthen innovation-oriented enterprises and research institutions**: National high-tech enterprises, research universities, and key laboratories serve as the core of building an ecosystem that links research outcomes to industrial applications through industry-academia-government collaboration. This approach is expected to enhance China's technological self-reliance and competitiveness.

・**Implementation of major scientific and technological projects aimed at breakthroughs**: This initiative seeks to deliver internationally competitive outcomes by concentrating national resources on fields such as artificial intelligence, next-generation communications (6G), domestic semiconductor production, space exploration, and biopharmaceuticals.

・**Development of high-level talent for building an innovation foundation**: The development of globally competitive scientific and technological talent is being promoted through reforms in university education, improvement of the research environment, and attraction of international talent. This study aims to ensure sustained long-term innovation capabilities.

- **Entrepreneurship support measures to promote industrial revitalization across society**: The cultivation of the entrepreneurial spirit and the development of emerging industries are being promoted through financial support for startups, the establishment of incubator facilities, and legal and institutional reforms to improve the entrepreneurial environment. Supporting young entrepreneurs and university-launched ventures is a key policy focus.

Overall, the "National Innovation-Driven Development Strategy Outline" is a national strategy that positions technological innovation as the cornerstone of the nation while integrating multifaceted factors, including regions, industries, human resources, and institutions, to build a comprehensive innovation system.

Table 2-1 Priority Areas in the National Innovation-Driven Development Strategy

Item	Priority Areas
Establish a competitive advantage in industrial technology within the international community	(1) Next-generation ICT technology (2) Smart and green manufacturing technology (3) Advanced agricultural technology (4) Advanced energy technology (5) Efficient use of resources and environmental protection technology (6) Marine and space technology (7) Smart city and digital society technology (8) Health care technology (9) Advanced service technology (10) Industrial transformation technology
Strengthen originality in basic research	(1) Strengthening Basic research and cutting-edge technology (2) Supporting basic research (3) Building infrastructure and platforms conducive to innovation
Optimize resource allocation by region for regional economic growth	(1) Building a model for regional development through innovation (2) Integrating innovation resources across regions (3) Constructing hubs serving as models and drivers of regional innovation
Promotion of dual-use technology (applicable to both civilian and military purposes)	(1) Establishing a macroscopic and unified approach to planning and implementation (2) Creating innovation through military-civil collaboration (3) Promoting integration of basic elemental technologies for both civilian and military use (4) Promoting bidirectional transfer and practical application of technologies between military and civilian sectors
Strengthen innovation-oriented enterprises and research institutions	(1) Fostering world-class innovation-oriented enterprises (2) Developing world-class universities and academic fields (3) Establishing world-class scientific research institutions (4) Expanding market-oriented, outcome-oriented R&D institutions (5) Professionalizing the technology-transfer service system
Implement major scientific and technological projects aiming at realizing breakthroughs	Establishing a system for the phased and continuous implementation of major special projects aimed at 2020 and major science and technology projects and initiatives aimed at 2030.
Development of high-level talent for building an innovation foundation	- Cultivating leading talent and a highly-skilled workforce in science and technology innovation - Exerting a critical role of entrepreneurs in R&D entrepreneurship - Establishing a talent development system based on "two pillars," high-end innovation talent and industrial skilled personnel
Entrepreneurship support to promote industrial revitalization across society	(1) Developing innovation space (2) Supporting and nurturing innovation-oriented small and micro enterprises (3) Encouraging innovation by the general public

Source: CRSC "Policy Transition and Development History of Science and Technology in China"

2.6 The 13th Five-Year Plan for Science and Technology Innovation (2016–2020)

The National People's Congress approved the five-year plan, and it was officially launched in March 2016. This was **the first medium-term plan formulated and implemented under the Xi Jinping**

administration based on its own economic and social governance policies, and it holds an important position in China. Unlike the previous five-year plans, this plan includes the word "innovation" in its title, suggesting that it integrates science and technology with the economy and innovation, encompassing the entire process from research and development to industrialization and innovation creation.

The Five-Year Plan sets the following goals:

1) Increase the ratio of R&D expenditures to GDP to 2.5% by 2020;
2) Increase the number of researchers per 10,000 workers in all of China from 48.5 to 60;
3) Raise the number of citations of international scientific papers from the 4th to the 2nd in the world.

Furthermore, the following **six major strategic missions** have been established.

1) To make a critical strategic move toward forming a first-mover advantage in innovation, encompassing both the immediate and future.
2) To cultivate key strategic innovation talent to improve creative innovation capabilities.
3) To strengthen innovation hubs by integrally coordinating all domestic and overseas bases as appropriate.
4) To promote "entrepreneurship by the masses and innovation by the people," and create a favorable environment conducive to startups.
5) To abolish systems that hinder innovation creation and transfer of outcomes and comprehensively deepen the reform of the science and technology system.
6) To solidify the foundation supported by the people and society for innovation and strengthen science popularization and the cultivation of innovation culture.

The 13th Five-Year Plan (2016–2020) designated major science and technology projects for the next five years, and industrial technology sectors to be intensively fostered. This strategy has triggered a shift from a manufacturing-oriented economy to a service- and consumption-driven one. In particular, initiatives such as "Made in China 2025," which promotes technological innovation, have positioned high-tech industries and the digital economy as key growth sectors. In parallel, efforts to strengthen basic research, improve living standards, and build technological systems related to national security and interests have advanced, forming a critical framework to support China's sustainable development. Table 2-2 shows the priority areas of the 13th Five-Year Plan.

Table 2-2 Priority Areas of the 13th Five-Year Plan

R&D Pillars	Priority Areas
Implementation of major science and technology projects	(1) research and development of large aircraft engines and gas turbines, (2) deep-sea station research, (3) quantum communications and quantum computers, (4) brain science and brain-inspired intelligence technology, (5) national cybersecurity research, (6) space exploration and Earth's orbital maintenance system research, (7) indigenous innovation in breeding technology and seed industry, (8) environmentally friendly and highly efficient coal utilization technology, (9) smart grid technology, (10) integration of satellite and terrestrial communication networks, (11) big data related technology, (12) intelligent manufacturing and robotics technology, (13) R&D and application of new materials, (14) comprehensive environmental protection in the Beijing-Tianjin-Hebei Region, and (15) technologies related to health and welfare.
Improvement of international competitiveness of industrial technologies	(1) advanced agricultural technology, (2) next-generation information and communication technology, (3) advanced manufacturing technology, (4) new materials technology, (5) environmentally friendly and highly efficient energy technology, (6) advanced transportation technology, (7) advanced biotechnology, (8) advanced food manufacturing technology, (9) service technology contributing to the evolution of business models, and (10) disruptive technology contributing to industrial revolution
Improvement of people's living standards and construction of technological systems capable of sustainable development	(1) environmental and ecosystem conservation technologies, (2) technologies for the efficient use of resources, (3) technologies contributing to public welfare, (4) technologies related to urbanization, and (5) technologies related to public safety.
Construction of technological systems related to national security and national interests	(1) marine resource utilization technology, (2) space exploration and space development technology, and (3) ultra-deep strata development technology
Strengthen basic research	**Strategic basic research for social needs**: (1) genetic improvement of agricultural products, (2) physics and chemistry theory for environmentally friendly use and high efficiency of energy, (3) information science for future human-machine-material integration, (4) integrated monitoring research of the earth system, (5) research on design and manufacturing process of new materials, (6) manufacturing technology in extreme environments (high current, strong magnetic field, ultra-high temperature and ultra-low temperature), (7) disaster and its prediction caused by mega projects, (8) dynamics-related problems concerning aircraft, rockets, and spacecraft, and (9) medicine and immunology **Advanced basic research**: (1) nanoscience and nanotechnology, (2) quantum control and quantum information, (3) protein complexes and control of life processes, (4) stem cell research and its translation into clinical applications, (5) advanced research using large research facilities, (6) analysis and countermeasures for global climate change, (7) genetics and environmental control of development, (8) synthetic biology, (9) genome editing, (10) research on deep sea, ultra-deep strata, and space, (11) research on deep-level structures of matter and astrophysics, (12) research on mathematics and its applications, and (13) research on magnetic confinement fusion research

Source: CRSC "Policy Transition and Development History of Science and Technology in China."

2.7 Amendment to the Law of the People's Republic of China on Scientific and Technological Progress (2021)

The Xi Jinping administration has been improving the environment and treatment in R&D and strengthening human resource development and support through the "Implementation Plan for the Reform of the Science and Technological System (2015)" and the "Opinions on the Evolution of the Reform of the Human Resource Development System Mechanism (2016)." As part of these efforts, the 13th Legislative Plan of the Standing Committee of the National People's Congress included a revision of the Science and Technology Law in 2018, and the decision to revise the law in December 2021 was formally adopted. The Law of the People's Republic of China on Scientific and Technological Progress was originally enacted in 1993, revised in 2007, and is currently undergoing a second revision.

The Law of the People's Republic of China on Scientific and Technological Progress, which comprises eight chapters and 75 articles, has been expanded to 12 chapters and 117 articles by **adding four chapters: basic research, local science and technology innovation, international scientific and technological cooperation, and management and supervision.** The main content of this law is outlined below.

(1) Legislative purpose and guiding principles (Articles 1–5)

Article	Main Contents	Purpose - Key Points
Article 1	Legislative Purpose	The purpose is to promote the development of the entire nation by demonstrating the roles of **"science and technology as the number-one productive force," "innovation as the number-one driving force," and "talent as the number-one resource."**
Article 2	Guiding Principles	Under the new development principles, science and technological innovation are placed at the core, and the strategies of "Talent Powerhouse" and "Innovation-Driven Development" are implemented.
Article 3	State Support	Encourage scientific and technological research and provide technological support for achieving decarbonization (carbon peaking and carbon neutrality).
Article 5	Security	Strengthen the capability to support national security through innovation by emphasizing the integrated operation of technology and security.

(2) Strengthen basic research (Articles 19–26)

Article	Main Contents	Purpose - Key Points
Article 19	Deepening of Research	Strengthen basic research in emerging industry fields and others, and promote creative innovation through R&D institutions.
Article 20	Fiscal Mechanism	The state provides stable financial support and guides enterprise investment to increase the proportion of expenditures on basic research.
Article 23	Talent Development	Focus on cultivating talent for basic research and improving the research environment.
Article 24	Construction of Basic Research bases	Strengthen the construction of basic research bases (such as institutes and laboratories).
Article 25	Support for Higher Education	Support the construction of basic research disciplines and talent training in universities.
Article 26	Integration with Application	Promote the integration of applied and basic research for mutual traction and conversion of achievements.

(3) Development of research environment (Articles 48–56)

Article	Main Contents	Purpose - Key Points
Article 48	Laboratory System	Establish a nationwide system for constructing national and key laboratories in fields that contribute to national security and economic development.
Article 54	Resource Sharing	Universities and research institutes established using fiscal support should establish systems for the open sharing of research resources.
Article 56	Innovation Entities	Form and support new-style innovation entities centered on new-style R&D institutions (e.g., mixed-ownership R&D centers).

(4) Strengthening support for research human resources (Articles 60–66)

Article	Main Contents	Purpose - Key Points
Article 60	Rewards and Incentives	Recommend reward systems for research human resources through stocks, options, and dividends.
Article 63	Evaluation System	Introduce rational evaluation systems tailored to fields and cycles to create an environment in which researchers can focus on their work.
Article 64	Reduction of Administrative Burden	Calls for simplifying administrative procedures, such as applications and reports for researchers, and avoiding redundant evaluations
Article 65	Research Safety and Allowances	Obligation to ensure safety and provide hazard allowances for personnel conducting research in hazardous environments or remote locations.
Article 66	Diversity and Inclusion	Establishes systems for the evaluation, training, and support of young, female, and ethnic minority researchers. Special considerations are also stipulated for women during pregnancy and lactation.

The law also addresses local science and technology innovations and international cooperation.

1) Regarding **local science and technology innovation**, it calls on people's governments at or above the prefecture level (province>city>prefecture) to actively support the application of science and technology, the conversion of achievements, and industrial development in the region. It encourages the construction of science and technology innovation and comprehensive science centers. Local enterprises are encouraged to participate in funding projects, promote research, and collaborate with industry and academia.
2) Regarding **international scientific and technological cooperation**, research institutions are encouraged to actively recruit and attract foreign researchers and improve funding project mechanisms so that foreign researchers can participate in China's scientific and technological funding projects. It also stipulates that outstanding foreign researchers should be given priority in obtaining permanent residency or naturalization.
3) Regarding **supervision and management**, the law emphasizes the rule of law in science and technology, improvement of the academic atmosphere of scientific research, establishment of a credit system for scientific research, and the development of an ethical governance system for science and technology.

2.8 Outline of the 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives through 2035 (2021–2025)

In March 2021, the "Outline of the 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives through the Year 2035 (hereinafter referred to as the 14th Five-Year Plan)" was approved at the Fourth Session of the 13th National People's Congress.

The year 2021 marks the 100th anniversary of the founding of the Communist Party of China. The 14th Five-Year Plan designated the five years from 2021 as **the first five years to advance toward the second centenary goal** of starting a new path toward comprehensively building a socialist modernized country after China had comprehensively achieved a moderately prosperous society and realized the first centenary goal.

In the previous Five-Year Plans, numerical targets were set as the major indicators of innovation. However, this time, it only stipulates that efforts should be made to ensure that investment exceeds the actual value achieved during the 13th Five-Year Plan period without presenting specific numerical targets. The 14th Five-Year Plan addressed the following topics:

(1) Science and technology-related topics

1) Optimize the allocation of science and technology resources
2) Resolve science and technology bottlenecks through innovation
3) Strengthen basic research
4) Build major science and technology innovation platforms
5) Enhance the technological innovation capabilities of enterprises
6) Unleash the innovative potential of human resources
7) Establish science and technology innovation systems

(2) Continuous strengthening of basic research

The content of basic research and support for human resources research substantially overlaps with the "Law of the People's Republic of China on Scientific and Technological Progress." Basic research stipulates that, in addition to continuous strengthening, the proportion of basic research expenditure in total R&D expenses should be raised to at least 8%.

(3) Advancement of support for research human resources

In supporting research human resources, the plan calls for human resource evaluation and incentive mechanisms, improving the soundness of the scientific and technological human resource evaluation system based on innovation capability, qualification, effectiveness, and contribution, establishing an income distribution mechanism that fully reflects the value of innovation factors such as knowledge and technology, comprehensively loosening management and supervision of research human resources, and expanding a "green channel (a simple, fast and safe channel, here meaning simplification)," for scientific research management.

(4) Reform in the science and technology innovation system

The primary focus of developing science and technology innovation systems is on reforming management systems. This approach implies reforming the approval and institutional management methods for major science and technology projects, granting greater autonomy to scientific research institutions and researchers, promoting a responsibility system led by chief technical officers, implementing systems such as "announcing rankings" ("揭榜挂帅," meaning open bidding for selecting innovation project leaders regardless of age or position through self-nomination) and "horse races" ("赛马," meaning competitive selection), and improving financial support mechanisms that combine rewards and supplements. Furthermore, it aims to strengthen S&T evaluation mechanisms, categorization, and evaluation systems for free exploration and task-oriented S&T projects, establish evaluation mechanisms for non-consensus S&T projects (i.e., scientific and technological ideas, methods, etc. that the mainstream S&T community has not yet recognized), and optimize S&T incentive projects.

(5) Construction of major national science and technology innovation platforms

Regarding the construction of major science and technology innovation platforms, the innovation functions of national indigenous innovation model zones, high-tech industrial development zones, and economic and technological development zones will be strengthened, and four major types of national science and technology infrastructure facilities will be constructed.

1) **Strategic orientation type**: Construct space environment ground-based monitoring networks, high-precision ground-based timing systems, large-scale low-speed wind tunnels, submarine scientific observation networks, space environment surface simulation devices, and comprehensive research facilities for critical systems of fusion reactor host computers.
2) **Application support type**: Construct of high-energy synchrotron radiation light sources, high-efficiency low-carbon gas turbine test equipment, ultragravity centrifugal simulation and test equipment, accelerator-driven transmutation research equipment, and future network test facilities.
3) **Cutting-edge and leading type**: Construct hard X-ray free-electron laser devices, high-altitude cosmic-ray observation stations, comprehensive extreme condition experimental devices, deep underground cutting-edge physical experimental facilities with very low background radiation, precision gravity measurement research facilities, and strong current heavy-ion accelerator devices.
4) **Improved livelihood type**: Construct translational medicine research facilities, multimodal and cross-scale biomedical imaging facilities, model animal phenotype and genetic research facilities, seismic science experiment sites, and Earth system science numerical simulators.

The challenges (bottlenecks) in the cutting-edge fields proposed in this plan are presented in Table 2-3.

Table 2-3 Challenges in cutting-edge fields in the 14th Five-Year Plan

01 New generation AI Make breakthroughs in cutting-edge basic theories and research, develop dedicated chips, build open-source algorithm platforms such as deep learning frameworks, and advance innovations in learning, inference, and decision-making across images and graphics, voice and video, natural language recognition and processing, and other fields.
02 Quantum information Research and develop intra-city, inter-city, and free-space quantum communication technologies; develop general-purpose quantum computer prototypes and practical quantum simulators; and make breakthroughs in quantum-precision measurement technology.
03 Integrated circuits Research and develop integrated circuit design tools, key equipment, and high-purity target materials, and other key materials, make breakthroughs in advanced IC processing, insulated-gate bipolar transistors (IGBT), micro-electromechanical systems (MEMS), and other special processing technologies, upgrade advanced storage technology, and develop silicon carbide, gallium nitride, and other wide-bandgap semiconductors.
04 Brain science and brain-inspired research Analyze the principles of brain cognition, map the mesoscopic neural connections of the brain, research mechanisms and interventions for major brain diseases and brain development of children and adolescents, and research and develop brain-inspired computing and brain-computer fusion technology.
05 Genetics and biotechnology Apply genomics research results, make technological innovations in genetic cells, and genetic breeding, synthetic biology, and biological drugs, research and develop innovative vaccines, in vitro diagnostics, and antibody drugs, create wide new varieties of crops, livestock, poultry, and aquatic products, and agricultural biologic products, and research key biosafety technologies.
06 Clinical medicine and health Perform basic research on the pathogenesis of cancer, cardiovascular, cerebrovascular, respiratory, and metabolic diseases, actively research and develop health interventions technology, research, and develop cutting-edge technologies such as regenerative medicine, microbiomes, and new treatments, and research key technologies for the prevention and treatment of major infectious diseases and major chronic non-communicable diseases.
07 Deep-space, deep-Earth, deep-sea, and polar explorations Perform basic scientific research on the origin and evolution of the universe and perspectives on the Earth, carry out interstellar exploration such as Mars orbiting and asteroid inspection, research and develop a new generation of heavy-lift launch vehicles and reusable space transportation systems, deep earth exploration equipment, deep-sea operations and maintenance (O&M) and equipment test ships, polar three-dimensional monitoring platforms, and heavy icebreakers, and complete construction of Phase IV of the lunar exploration project, Phase II of Jiaolong Sea Exploration, and Phase II of Xuelong Polar Exploration.

Source: SPC, "Outline of the 14th Five-Year Plan for National Economic and Social Development and the Long-Range Objectives through the Year 2035."

2.9 Amendment to the Regulation on National Science and Technology Awards (2024)

The draft amendment to the "Regulation on National Science and Technology Awards," released in October 2020, proposed changing the selection process for annual science and technology awards from a recommendation-based system to a nomination-based system, clarifying the evaluation criteria, and improving the transparency and credibility of the selection system. Subsequently, in May 2024, the State Council released another draft amendment to the Regulation on National Science and Technology Awards (enacted in 1999, first amended in 2003, second amended in 2013, and third amended in 2020) to further improve the system.

The Regulations consist of five chapters and 38 articles. Chapter I outlines the General Provisions (Articles 1–7), while Chapter II addresses the Establishment of National Science and Technology Awards (Articles 8–13). Chapter III covers the nomination, evaluation, review, and awards of the National Science and Technology Awards (Articles 14–27). Chapter IV concerns Legal Liabilities (Articles 28–35), and Chapter V includes Supplementary Provisions (Articles 36–38).

The key points of this amendment are summarized in three main areas:

1) Relaxation of nationality requirements for award recipients (Chinese nationality is no longer required).
2) Orientation beyond science and technology development to encompass the construction of an innovation-driven nation and a global science and technology powerhouse.
3) Adherence to the unified guidance of the Party Central Committee and alignment with the national strategic direction of all activities related to scientific and technological progress.

Table 2-4 Comparison of the contents of the Regulation on National Science and Technology Awards

Before revision (2020 version)	After revision (2024 version)
Article 1: The present Regulation is hereby formulated for the purpose of encouraging the **citizens** and organizations that have made outstanding contributions to the scientific and technological progress activities, mobilizing the enthusiasm and creativity of scientific and technological workers, and **accelerating the development of science and technology, as well as improving the comprehensive national strength.**	Article 1: The present Regulation is amended for the purposes of encouraging the **individuals** and organizations that have made outstanding contributions in scientific and technological progress activities, mobilizing the enthusiasm and creativity of scientific and technological workers, and **building an innovation-oriented country and a global superpower in science and technology.**
Article 2: **The State Council** establishes the following national science and technology awards: (1) State Preeminent Science and Technology Award. (2) State Natural Science Award. (3) State Technological Invention Award. (4) State Scientific and Technological Progress Award. (5) China International Science and Technology Cooperation Award.	Article 2 **The state** establishes the following national science and technology awards: (1) State Preeminent Science and Technology Award. (2) State Natural Science Award. (3) State Technological Invention Award. (4) State Scientific and Technological Progress Award. (5) China International Science and Technology Cooperation Award.
Article 3: National science and technology awards shall be closely integrated with the major strategic needs and medium and long-term science and technology development plans of the state. The state increases rewards for fundamental research in natural sciences and applied fundamental research. The State Natural Science Award shall focus on foresight and theoretical property, the State Technological Invention Award shall focus on originality and practicality, and the State Scientific and Technological Progress Award shall focus on innovation and effectiveness.	Article 3: **National science and technology awards shall be kept in line with the national strategic orientation** and be closely integrated with the needs of the major strategies and medium and long-term science and technology development plans of the state. The state increases rewards for fundamental research in natural sciences and applied fundamental research. The State Natural Science Award shall focus on foresight and theoretical property, the State Technological Invention Award shall focus on originality and practicality, and the State Scientific and Technological Progress Award shall focus on innovation and effectiveness.

Article 4: **The work concerning national science and technology awards shall adhere to the leadership of the Communist Party of China**, implement the innovation-driven development strategy, implement the policies of "respecting labor, knowledge, talents, and creation", and cultivate and practice socialist core values.	Article 4: **The work concerning national science and technology awards shall adhere to the centralized and unified leadership of the CPC Central Committee,** implement the innovation-driven development strategy, implement the policies of "respecting labor, knowledge, talents, and creation", and cultivate and practice socialist core values. **Major matters relating to the work concerning national science and technology awards shall be reported to the CPC Central Committee in accordance with relevant provisions.**
Article 7, paragraph (2): The members of the State Science and Technology Awards Commission shall be nominated by the science and technology administrative department of the State Council and **be reported to the State Council for approval.**	Article 7, paragraph (2): The members of the State Science and Technology Awards Commission shall be nominated by the science and technology administrative department of the State Council and **be reported to the CPC Central Committee and the State Council for approval.**
Article 21: The science and technology administration department of the State Council shall examine and verify the resolution made by the State Science and Technology Awards Commission on the persons on whom different types and grades of awards are to be conferred, and submit the results to **the State Council for approval.**	Article 21: The science and technology administration department of the State Council shall examine and verify the resolution made by the State Science and Technology Awards Commission on the persons on whom different types and grades of awards are to be conferred, and submit the results to the State Council and **the CPC Central Committee for approval.**
Article 22, paragraph (2): The certificates and prize money for the State Natural Science Award, the State Technological Invention Award , and the State Scientific and Technological Progress Award shall be bestowed **by the State Council.** Paragraph (3): The medal and certificate for the International Scientific and Technological Cooperation Award of the People's Republic of China shall be bestowed **by the State Council.**	Article 22, paragraph (2): The certificates and prize money for the State Natural Science Award, the State Technological Invention Award , and the State Scientific and Technological Progress Award shall be bestowed. Paragraph (3): The medal and certificate for the International Scientific and Technological Cooperation Award of the People's Republic of China shall be bestowed.
Article 25: The amount of the prize money for the State Preeminent Science and Technology Award shall be determined by the State Council.	Article 25: The amount of the prize money for the State Preeminent Science and Technology Award shall be proposed by the science and technology administration department of the State Council jointly with the finance department, and **be submitted to the CPC Central Committee and the State Council for approval.**
Article 30: Where a winner plagiarizes or appropriates another person's discoveries or inventions or other scientific and technological results, or obtains a State science and technology award through fraud or by other illegitimate means, the science and technology administration department of the State Council shall, **with the approval of the State Council,** revoke the award and recover the medal, certificate and prize money of the award, and the unit to which he belongs or the relevant department shall impose a sanction on him or it in accordance with law.	Article 30: Where a winner plagiarizes or appropriates another person's discoveries or inventions or other scientific and technological results, or obtains a State science and technology award through fraud or by other illegitimate means, the science and technology administration department of the State Council shall, with the approval of **the CPC Central Committee and the State Council,** revoke the award and recover the medal, certificate and prize money of the award, and the unit to which he belongs or the relevant department shall impose a sanction on him or it in accordance with law.

Source: Prepared by the author based on the 2020 and 2024 versions of the Regulation on National Science and Technology Awards.

2.10 Resolution of the Central Committee of the Communist Party of China on Further Deepening Reform Comprehensively to Advance Chinese Modernization (2024)

In July 2024, at the Third Plenary Session of the 20th Central Committee of the Communist Party of China, the "Resolution on Further Deepening Reforms Comprehensively to Advance Chinese Modernization" was adopted, **a policy aimed primarily at promoting key reforms over the next five years** to achieve socialist modernization by 2035.

Although it is a lengthy policy document consisting of three major categories, 15 sections, and 60 items, the first category addresses the great significance and overall requirements of further deepening reform comprehensively and promoting Chinese-style modernization, while the second outlines reforms in the areas of economy, politics, culture, society, ecological civilization, national security, national defense, and the military. The third category concerns strengthening the party's leadership and guiding the reform ideology.

In building a high-standard socialist market economy, the document emphasizes adherence to and implementation of the "**two unswerving commitments**" and **advancing the development of a unified national market.** The "two unswerving commitments" refer to unswervingly consolidating and developing the public economy sector and unswervingly encouraging, supporting, and guiding the development of the non-public economy sector.

○ The main contents of the development of a unified national market:

1) Promote the unification of basic market systems and rules, fair and unified market supervision and management, and high-standard connectivity between market facilities.
2) Strengthen strict regulations through fair competition reviews, intensify crackdowns on monopolistic and unfair competition practices, and reorganize and abolish various rules and practices that impede the development of a unified national market and fair competition.
3) Standardize local regulations and systems related to attracting businesses and strictly prohibit the implementation of preferential policies that violate laws and regulations.
4) Establish and improve a unified, standardized system for public resource trading platforms that facilitates information sharing for competitive bidding and procurement by the government, public institutions, and state-owned enterprises to ensure full transparency throughout the project management process.
5) Enhance capabilities and levels of comprehensive market supervision and management. Develop a national standards system and deepen reforms to local standards management systems.

○ Goals by 2035:

1) Build a high-standard socialist market economy system in all aspects.
2) Further improve the system of socialism with Chinese characteristics.
3) Promote the modernization of the national governance system and governance capacity.
4) Basically realize the socialist modernization.

5) Lay a solid foundation for building a great modern socialist country in all aspects by the middle of this century.

○ Seven key areas to be prioritized to achieve the above goals:

1) Focus on building a high-standard socialist market economy system.
2) Focus on developing a whole-process people's democracy.
3) Focus on building a socialist cultural powerhouse.
4) Focus on improving the quality of people's lives.
5) Focus on building a "Beautiful China."
6) Focus on building a higher level of "Peaceful China.
7) Focus on improving the Party's leadership and long-term governance capacity.

In the field of science and technology, establishing systems and mechanisms that support comprehensive innovation was identified as a key focus, encompassing three main factors.

1) Deepening comprehensive reform in education

Key Points	What is included
Optimize higher education	Work faster to develop world-class universities and strong disciplines. Establish discipline adjustment mechanisms to meet the needs of science and technology development and the national strategy.
Reform talent training models	Develop basic disciplines, emerging disciplines, and interdisciplinary subjects. Cultivate top talent, with a strong emphasis on fostering innovative capacity.
Utilize achievements and improve education	Refine the mechanisms for applying scientific and technological achievements in universities. Emphasis on the coordinated development of scientific and technological education and humanities education.
Promote the internationalization of education	Expand high-standard opening up in the education sector. Encourage foreign universities of science and engineering to work together in China

2) Deepening scientific and technological structural reform

Key Points	What is included
Strong strategic, scientific, and technological capabilities	Build and optimize the national laboratories' systems. Strengthen collaboration among national research institutions, research universities, and leading enterprises.
Central and local collaboration	Work on the coordinated development of national-level scientific and technological innovation platforms.
Support new types of R&D institutions	Promote integrated industrial innovation by leveraging China's enormous market.
Science and technology security	Establish risk-monitoring, early-warning, and response systems. Strengthen self-sufficiency in scientific and technological infrastructure
Expand international science and technology cooperation	Encourage the establishment of international science and technology organizations in China. Improve the dedicated management mechanisms for international research cooperation in universities, research institutes, and other organizations.

3) Deepening institutional reforms for talent development

Key Points	What is included
Implement a proactive, open, and effective talent development policy	Improve the mechanisms for nurturing talent at home and develop platforms for pooling talent.
Strengthen national strategic talent capacity	Strengthen the cultivation of scientists, innovation leaders, engineers, and skilled workers. Also focuses on developing top-notch, highly-skilled workers.
Establish incentive mechanisms for talent	Grant employers' greater authority, easing regulatory restrictions on talent. Introduce personnel assessment systems that emphasize capabilities, quality, outcomes, and contributions.
Ensure talent mobility	Establish channels for talent mobility among higher education institutions, research institutions, and enterprises.
Recruit and support talent from overseas	Improve the support and guarantee mechanisms for recruiting talent from overseas and create internationally competitive personnel systems.

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3 Funding Allocation Policy

Policies on fund allocation from 2014 onward are described in this chapter, along with policies on fund allocation implemented before 2014, which are outlined in the first section.

3.1 Major Fund Allocation Plans for Scientific and Technological Research Prior to the Reform in 2014

Other than the Spark Program, the 863 Program, and the Torch Program explained in Section 1.2, several important fund allocation programs for scientific and technological research in China were implemented before 2014. The State Key Laboratory Construction Program was launched in 1983 as an initiative to strengthen the foundation of scientific and technological research focusing on aerospace, electronics, biotechnology, materials science, and related fields through the construction of laboratories in domestic universities and research institutes, with intensive allocation of funds and support in these areas. This program contributed to the development of outstanding researchers and the establishment of international research networks, promoting industrial applications of research achievements. The 973 Program, launched in 1997, was a national initiative aimed at strengthening basic research in China and supporting the advancement of scientific and technological research, encompassing life sciences, geoscience, physics, materials science, energy, and the environment. It marked a significant step forward in strengthening the foundation and long-term development of science and technology in China, facilitated through research achievements that benefit industry and society, as well as international research collaboration. Major fund allocation plans for scientific and technological research prior to 2014 are shown in the table below.

Table 3-1 Major fund allocation plans for scientific and technological research in China (before the national reform in 2014)

Year	Project name	Main mission and overview
1982	National Key Technology R&D Program	The first national scientific and technological research program. Projects were conducted in agriculture, electronics/information, energy, transportation, materials, natural resources, medical services, environmental protection, and other fields to solve key issues related to national economic and social development.
1983	State Key Laboratory Construction Program	Prepares suitable experimental environments for basic and applied research in China, maintains and stabilizes core teams for basic research, and optimizes personnel placement and fund allocation.
1984	National Key Industrial Test Project	Implements large-scale verification of production and technology integration after obtaining test results, evaluates the feasibility and economic rationality of large-scale production of technology and equipment, and promotes industrialization.
1985	National Key New Technology Promotion Project	Transfer scientific and technological achievements promptly to enterprises, thereby enhancing productivity and contributing to national economic development.

Year	Project name	Main mission and overview
1986	Spark Program	A project implemented to develop agricultural technologies and promote urbanization.
	863 Program	A national high-technology research and development program. Its focus areas include biotechnology, space, ICT, lasers, automation, new materials, and marine technologies.
	Military–Civilian Conversion Science and Technology Development Program	Enhances scientific and technological development through the transfer of military technologies to civilian sectors, promotes industrialization of transferred achievements, and coordinates technology transfer with local economic development.
	National Key New Products Program	Encourages and guides the voluntary development of new products by enterprises, business units, and/or research institutions; promotes the adjustment of industrial and product structures; and accelerates the transfer of scientific and technological achievements.
1988	Torch Program	Leverages China's scientific and technological strengths to promote market-oriented commercialization and industrialization of high-end technologies and products, as well as their internationalization.
	National Science and Technology Achievement Key Promotion Plan	Widely applies advanced, mature, and applicable scientific and technological achievements to key sectors of the national economy, accelerates the transfer of achievements, promotes the integration of science and technology with the economy, and enhances the economic contribution of the scientific and technological research.
1989	National Soft Science Research Program	Primarily supports research on strategic and policy issues related to the advancement and reform of scientific and technological research on key issues in promoting economic growth and social development through science and technology and future issues in national economic and social development, providing scientific evidence for policy decision-making.
1990	National Basic Research Major Project Plan	Includes major core technology projects based on relatively mature basic research that influences national growth and scientific and technological development.
1991	National Process (Technology) Research Center Project	Includes National Process Research Center Projects and National Process Technology Research Center Projects, aiming to enhance process engineering capabilities and technological integration.
1992	Social Development Science and Technology Plan	Addresses scientific and technological issues in social development fields, including environmental protection, rational development and utilization of natural resources, disaster prevention and mitigation, population management, and public health, and promotes sustainable and balanced economic and social growth.
1996	973 Program	The national Key Basic Research Program, focusing on agriculture, energy, information, natural resources and environment, population and health, and materials, as well as major scientific issues related to the national economy, social development, and scientific and technological advancement.
1997	Knowledge Innovation Project	Enhances basic and advanced research conducted by the Chinese Academy of Sciences.
1998	Science and Technology SME Technology Innovation Fund	Supports and promotes technological innovation by science and technology–based small and medium-sized enterprises.

Year	Project name	Main mission and overview
1999	Research Institute for Science and Technology Development Special Project Fund	Supports applied research and development activities for high-technology products and process technologies, mainly through central government–level technology development research organizations.
	Science and Trade Action Plan	Aims to adjust China's export structure to enhance export competitiveness and risk management capability.
	Funding for Special Projects on Basic Science and Technology Work at Central Scientific Research Institutes	Promotes the preparation and advancement of basic systems for scientific and technological research, gradually establishes and improves resource- and achievement-sharing mechanisms, and ensures social cooperation for resource sharing, with central government–level research institutes as the main implementing entities.
2000	Public Research Special Project of the Chinese Academy of Sciences	Focuses on building social and public research bases, creating public interest research networks, protecting technologies for sustainable social development and public services, and enhancing the level and capacity of sustainable innovation in public interest research.
	International Science and Technology Cooperation Priority Project Plan	Implements high-level international scientific and technological cooperation projects, enables Chinese science and technology personnel to participate on an equal footing, and shares achievements through mutually beneficial collaboration.
2001	Agricultural Science and Technology Achievement Transformation Fund	Attracts funding from enterprises, scientific and technological organizations, government agencies, research institutes, industry support organizations, and financial institutions; supports the early-stage transformation of agricultural scientific and technological achievements into production; adapts to the socialist market economy; establishes systems suited to agricultural scientific and technological development; and efficiently promotes the transfer of agricultural scientific and technological achievements into practice.
2002	Three Gorges Immigrant Science and Technology Development Special Project	Promotes economic advancement through the development, diffusion, and introduction of advanced applied technologies; develops common and core technologies for ecological construction; fosters core industries and characteristic emerging industries in the Three Gorges area; restores and manages the ecological environment of the Three Gorges Dam area; and advances computerization and modernization efforts.
2003	National Science and Technology Foundation Platform Construction Special Project	Uses modern technologies such as computers and networks to reorganize and optimize resources strategically and systematically as fundamental conditions for scientific and technological development, promoting efficient allocation and comprehensive utilization of resources across society and improving national innovation capacity. It includes large scientific equipment, experiment research bases, systems for the preservation and utilization of natural science and technology resources, shared service networks for scientific data and documentation, public service platforms for technology transfer, and a network environment.
2004	National Science and Technology Support Program	Focuses on addressing major scientific and technological challenges in economic and social development to meet the needs of national economic and social progress.
2006	National Science and Technology Major Specific Projects	Aims to achieve national strategic goals through concentrated resource allocation and technological breakthroughs, with project objectives adjusted in coordination with the Five-Year Plans.

Year	Project name	Main mission and overview
	Science and Technology Benefit Program	Promotes the transfer and application of civilian scientific and technological achievements to improve public welfare and support social development through science and technology.

Source: CRSC, "China's Science and Technology Policy Transition and Development History"

3.2 Some Thoughts on Improving and Strengthening the management of Central Financial Scientific Research Project Funds (2014)

This policy was proposed to enhance the efficiency and transparency of research fund management. It aims to enforce comprehensive oversight of science research funds distributed by central financial agencies, emphasizing innovation as an enhancement and typification of management, specifying rules, ensuring accountability, and rationalizing the management of personnel, property, and materials.

(1) Background

In March 2014, the State Council announced proposals for improving and strengthening the management of central financial scientific research project funds.

The background and purpose of the announcement are summarized in the foreword: "Since the implementation of the Outline of the National Medium- and Long-term Science and Technology Development Plan (2006–2020), financial investment has increased significantly, supporting the development of science and technology. However, these projects have become disorganized, with some being redundant, management lacking scientific rigor and transparency, and fund utilization becoming inefficient. To address these issues, we aim to establish a fund management system that ensures open and transparent administration through reforms in the science and technology system."

(2) Key details

The government addressed these issues by strengthening fund management to enhance and standardize management, specify rules, and ensure accountability. An overview of the announcement is as follows:

1) Integrated coordination for science and research projects and funding

- Organize and consolidate redundant and disorganized projects to allow systematic fund allocation aligned with national strategies.
- Define clear roles for each government office, emphasizing a balance between quality and quantity in project numbers.
- Centrally manage all projects using the National Science and Technology Management Information System.

2) Classification and management of science and technology projects

Classification	Characteristics / Objectives	Policy for handling
Basic/advanced research	Focus on creativity	Respect the opinions of experts and peer assessment
Public interest research	Respond to public needs	Emphasize applicability and social contribution
Market-oriented	Led by companies	Provide ex-post support for actual expenses
Key projects	Respond to national strategies	Set clear targets and allocate intensive investment

3) Improvement of fund management for science and technology projects

- Management by type: Develop public offering guidelines for each type and regularly announce them to facilitate researcher access.
- Transparency of application and review: Prevent duplicate or invalid applications. Examinations must be completed within 120 days.
- Clear accountability during project implementation: Affiliated organizations are responsible for management and quality checks at the appropriate intervals.
- Rigorous final examination: Projects not accepted within the specified timeline are judged as "Fail." Third parties and user evaluations are leveraged. Key projects are tracked even after practical application.

4) Strengthened the administration and management of science research projects and funding

Key Points	Included details
More stringent fund usage rules	Funds must be used within the stipulated scopes and procedures.
	Cash usage is prohibited; principal investigators in universities and research institutes must use official cards.
Introduction of the credit management system	Credit records are maintained at every stage.
	Authorization is revoked for serious violators through a block-list system.
Strict sanctions against violations	Public criticism, suspension of funds, and legal actions against misconduct.
	Recovery of disbursed funds and revocation of authorization.

3.3 Plan Regarding the Enhancement of Management Reform of the Central Fund National Science and Technology Project (Funds, etc.) (2015)

This organized and reformed multiple funding projects into five categories: the National Natural Science Foundation of China, National Science and Technology Major Specific Projects, National Key Research and Development Plan, Science and Technology Innovation Guidance Plan, and Research Sites and Human Resource Planning.

(1) Background

In 2015, the State Council announced a plan to enhance management reform of the Central Fund National Science and Technology Project following funding innovations. This plan organized and restructured funding projects into five types. Since the Reform and Opening-Up in 1978, the Chinese government has significantly increased investment in scientific and technological research and development, funding projects for science, technology, and human resources. Major initiatives included the National Key Technology R&D Program (1978), the National Natural Science Foundation Committee (NSFC)-led funding projects, the Spark Program, the National High-tech Research and Development Plan (863 Program), the National Key Basic Research Program (973 Program), and the National Science and Technology Key Specialized Program.

However, the rapid proliferation of projects led to dispersed and redundant initiatives, unscientific or non-transparent management, and low fund utilization efficiency.

(2) Integration into five funding projects

To address these challenges, funding projects were integrated and reformed into five categories in 2015:

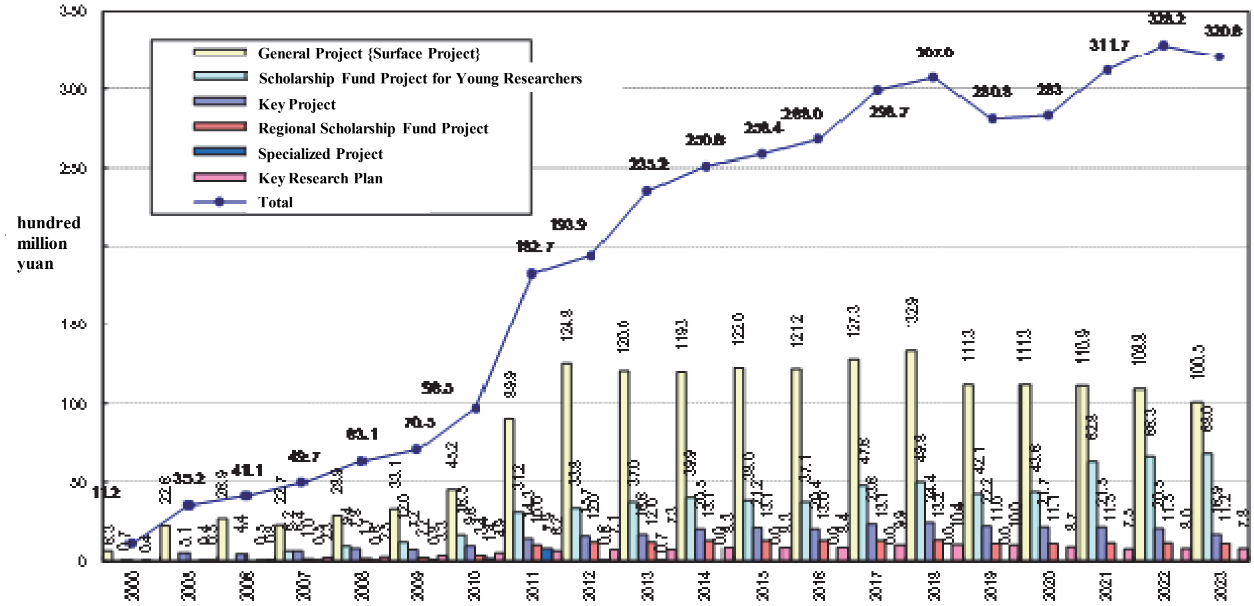
Table 3-2 Five funding projects

	Type	Overview	Controlling Department	Notes
1	National Natural Science Foundation	Supports basic and applied research; emphasizes originality and supports young researchers.	The Ministry of Science and Technology	
2	National Science and Technology Major Specific Projects	Complete critical processes of key general-purpose technologies within a defined timeframe through breakthroughs in core technologies and resource concentration.	State Counsel	Many projects align with a 5-year plan.
3	National Key Research and Development Plan	Addresses bottlenecks in key fields of the national economy, civil sector, industrial competitiveness, independent innovation, and national security.	Science and Technology Department	Includes the 973 Program and 863 Program
4	Science and Technology Innovation Guidance Plan	Promotes innovation in companies and startups, particularly by youth, including university students.	-	Local governments implement policies in line with central government guidance, considering regional characteristics.
5	Research Sites and Human Resource Planning	Enhances local innovation capability by leveraging regional resources, establishing innovation sites, and developing talent.	-	Local governments implement policies consistent with central guidelines while considering regional characteristics.

Source: Created by the author based on various documents.

Even after integration and reform, the central government continued to invest heavily in science and technology. According to the Ministry of Finance's budget plan, investment in the science and technology sector in 2025 is projected at 398.12 billion Yuan, an increase of approximately 10% YoY.

The National Natural Science Foundation's budget, responsible for supporting basic research, increased from 36.314 billion Yuan in 2024 to 39.458 billion Yuan in 2025. The budget trend through 2023 is shown in Graph 3-3.



Source: APRC, China Science and Technology Overview 2025.

Figure 3-3 Trend in the budget of the National Natural Science Foundation

The National Science and Technology Major Specific Projects, primarily linked to the central government's five-year plan, focus on breakthroughs in core technologies to achieve national targets. In 2024, six applications were announced: "Orbital Service and Maintenance System for Spacecrafts," "Comprehensive Environmental Measures for Beijing/Tianjin/Hebei," "Research on Prevention and Treatment of Cancer and Cardiovascular, Respiratory and Metabolic Diseases," "Quantum Communication and Quantum Computers," "Exploration of Seismic Bedrock," and "Smart Grid."

The National Key Research and Development Plan consolidates conventional projects such as the 973 Program and the 863 Program. Smaller in scale than the Major Specific Projects, its target critical problems in science, technology, and socioeconomic development, with 82 project applications announced in 2024.

(3) Preparation of the operational system

To prepare the operational system, interdepartmental liaison meetings, specialized organizations, strategic advisory, and comprehensive review committees were established.

1) [Newly Established] Interdepartmental Liaison Meeting (hub function of related ministries and agencies)

Item	Description
Major Participants	Science and Technology Department, Ministry of Finance, National Development and Reform Commission.
Major Roles	Ensure alignment with the national science and technology strategy; discuss project system design and key missions; coordinate policies and implementation.
Related Operations	Coordinate R&D with industrial standards and policies; reflect basic, public interest, and core technology needs; promote societal and industrial application of results.

2) [Newly Established] Specialized Organization (driving force of project operations)

Item	Description
Method of Establishment	Transfer or reorganize existing research organizations into specialized organizations for project management.
Major Operations	Receives project applications; manage examination, implementation, acceptance, and confirmation; coordinated with the National Science and Technology Management Information System.
Management Structure	Establish a council and supervisory board; outsource missions based on liaison meetings' decisions.
Quality Management	Conduct regular evaluation, supervision, and improvement; comply with commission consultation and system; select experts nationwide for reviews.

3) [Newly Established] Strategic Advisory and Comprehensive Review Committee (Brain of wisdom and review)

Item	Description
Structure	High-level experts in science, technology, industry, and economics.
Main functions	Supports strategy development in science and technology and key projects; develop project review rules; promote professional reviewer training and standardization.
Specific operations	Review of key projects; provide advice and proposals to liaison meetings; improve consultation quality in collaboration with academic institutions and societies.

3.4 Some Thoughts on Improving the Policies on the Management of Scientific Research Project Funds by Central Finance (2016)

The management of scientific research project funds has been strengthened over the past two years since 2014. This policy represents a shift from a stringent management structure toward the optimization of fund distribution. The management system transitioned to a human-centric approach, relaxing fund management for science and research projects. To create an environment where researchers can concentrate on their work, burdensome procedures were reviewed to enhance the flexibility, transparency, and efficiency of budget execution.

(1) Background

The Chinese government, which had been implementing reforms of the fund management system for two years, shifted its policy from strict management to optimized fund distribution once the new system became partially established. "Some Thoughts on Improving the Management of Scientific Research Project Funds through Central Finance," issued by the State Council in July 2016, emphasized centralizing human resources, simplifying administration, delegating authority, unifying authority transfer and management, and optimizing services. The most significant change was the relaxation of fund management for science and research projects.

(2) Key details

Points of the Reform	Overview
Simplification of the budget planning process and transfer of authority to lower organizations	・Flexibility of budget allocation: Allocation of direct spending (materials, experiment, publishing, etc.) without changing the total budget is determined by the commissioned organizations. ・Integration of budget items: Expenses on meetings, business travel, and international exchanges are consolidated to allow usage according to the situation. ・No backup documents required for adjustments of 10% or less, giving researchers greater discretion.
Raising overhead costs and recommendations for a lump-sum payment for achievements	・Upper limit of overhead cost for each project: ∇ 5 million Yuan or less: 20% ∇ More than 5 million to 10 million Yuan: 15% ∇ More than 10 million Yuan: 13% ・Lump-sum payment: Abolish limitations on the ratio of lump-sum payment to a researcher for achievements, encouraging performance-based rewards.
Enlarging the scope of labor expense and abolishing limitations	・Can be paid to students, postdoctoral fellows, and part-time researchers, regardless of the title. ・Social insurance and related benefits can be included. ・No upper limit on expense ratio, allowing flexible allocation of labor costs.
Review of handling surplus and carryover funds	・Funds can be carried over to the next fiscal year. ・Can be spent for two years after project completion (as direct research expense). ・Unused surplus after two years must be returned.
Normative management of commissioned research	・Commissioned research expenses obtained from the market are placed under the organization's financial management and used according to the contract. ・Can be used flexibly if the contract is followed.
Simplification of infrastructure and traveling/meeting expenses	・Enhance the autonomy of university/research institutions' construction projects; prior reporting to or approval by government agencies is unnecessary. ・Each university establishes its travel and meeting expense rules to improve efficiency and reduce expenses.

3.5 Some Thoughts on Reforming the Management of Scientific Research Expenses through Central Financing (2021)

This policy document represents a well-balanced reform aimed at increasing flexibility and efficiency in expense management so that researchers can focus on research activities while enhancing responsibility, fair assessment, and supervision. Direct expenses were reorganized into three categories: equipment, operation, and labor. Measures were introduced to increase researchers' autonomy, including allowing the total amount of indirect expenses to be paid as a lump sum, increasing motivation.

(1) Background

The State Council issued "Some Thoughts on Reforming the Management of Scientific Research Expenses by Central Finance" in August 2021 to further transfer authority. The document notes as follows: "To strongly motivate researchers' vitality and innovation capabilities for the evolution of science and technology, expense management reforms have been ongoing for several years. However, issues such as strict management control remain, expense allocation is not straightforward, indirect expense ratios are low, and expense settlement is cumbersome. Therefore, further reforms are necessary." A key point is the expansion of researchers' independence in spending.

(2) Key details

Point of the reform	Major changes
More autonomy in expense management	· Simplification of budget items: Direct expenses reorganized into equipment, operation, and labor. · No details required for equipment expenses under 500,000 Yuan; procurement review was not necessary. Budget decisions can be made by the organization. · For basic research and projects of young research projects, the "Engulfment System" abolishes ratios and purpose restrictions on expense items, allowing voluntary allocation and increasing flexibility.
Improvement of the expense allocation system	· Develop a fund allocation plan based on project progress and needs; initial payment ratios reflect the representative researchers' opinion. · Funds provided within 30 days after contract signing. · Surplus at project completion belongs to the commissioned organization.
Enhancing researchers' incentives	· Raise upper limit ratio of indirect expenses (e.g., for ≤ 5 million Yuan, 30%; for pure theoretical fields, up to 60%). · Indirect expenses can be paid as a lump sum to researchers. · Expanded labor expense scope: payment regardless of title, including social insurance and housing reserve. · Compensation for researchers contributing to results transfer.
Reducing administrative burden	· Introduce the financial assistant system to handle expense processing. · Promote paperless processes and online payment. · No details required for accommodation and meal expenses during travel. · Finance and technology inspection performed simultaneously; financial inspection may be omitted for highly trusted institutions. · Equipment procurement should be competitive; emergency special arrangements allowed within five days. · No upper limit for international collaboration expenses; excluded from "Sankoh (three public)" expenses (entertainment, official vehicle, overseas travel).
Utilization of various expense support and funds	· Promote use of corporate and private capital. · Leading researchers select research themes and organize teams voluntarily with sufficient funding. · Achievements evaluated by a third-party or international institution. · Negative list system for new rural research institutions to allow flexible expense implementation.
Performance-oriented assessment and supervision	· Focus on achievements: different criteria for free investigation and mission-oriented research. · Use assessment results for project continuation or review. · Random investigations conducted and results shared to ensure healthy financial practices. · Credit recording and disciplinary actions for misconduct. · Policy promotion, training, pilot assessment, and dissemination implemented.

3.6 Evaluation of the Funding Policy

(1) Achievements

The Chinese government has positioned science and technology innovation at the core of national development and has been actively reforming research fund allocation policies. R&D investment in China reached 2.64% of GDP in 2023, second only to the United States, and ranks highly globally in patent applications and scientific publications, with a strong presence in 5G, EV, and AI. Key policy changes include transparent and efficient fund management, wider research discretion, and an achievement-oriented assessment system.

The reforms have empowered researchers to use funds flexibly through simplified budget items and the lump-sum funding system, enabling prompt decision-making and budget adjustments, thereby improving research efficiency. Indirect and labor expense coverage has increased, and lump-sum funding arrangements have enhanced the motivation, retention, and engagement of young talent.

Administrative burden has decreased, with finance assistance systems, paperless reimbursement, and flexible equipment procurement allowing researchers to focus on their work. Collaboration with diverse funding entities, including companies and local institutions, enhances responsiveness to national priorities and regional technological development.

(2) Issues

Some challenges remain. First, achievement-oriented assessment may become formalistic, especially in investigator-initiated research, potentially limiting flexibility and creativity. Second, China's fund allocation emphasizes strategic concentration in key fields, such as AI, semiconductors, quantum technology, and biotechnology, via the National Key Research and Development Plan. While effective for technological breakthroughs, transparency issues remain in expert selection and in ensuring assessment fairness. Variations in local government implementation and system operation also affect reform effectiveness.

Overall, China's fund allocation policies represent an ambitious attempt to balance centralized system design with flexible operation, improving the research environment. Further refinement of assessment and supervision systems and reliable system operation will be crucial to achieving high-quality innovative research.

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6. Zhang Yaofang (Chinese higher education research, October 2022)
7. Central People's Government of China (March 2022)
8. Yangliu (Commercial Observation, July 2023)

4 Talent Policy

This chapter introduces the major human resource policies implemented in the 2010s. First, it outlines the evolution of China's human resource policies and related initiatives.

4.1 Evolution of Human Resource Policies and Related Initiatives in China

With the founding of the People's Republic of China in 1949, institutions such as the Chinese Academy of Sciences were established, and the country showed steady progress. However, the Great Leap Forward of 1958 and the Cultural Revolution, which began in 1966, severely affected the nation's scientific and technological personnel. Only after the Reform and Opening-Up policy of 1978 did the functions of the Chinese Academy of Sciences and universities return to normal.

(1) Rehabilitation and Readjustment Period (1978–1984)

During this period, the Central Government of the People's Republic of China introduced 27 human resource policies. Their main focus was on restoring the honor and status of intellectuals who suffered during the Cultural Revolution.

Table 4-1 Key Terms in Academic and Technical Personnel Policy and Their Frequency of Appearance in Policy Documents (1878–1984)

Key Terms	Frequency	Key Terms	Frequency
Social security	17	Overseas talent recruitment	6
Salary and benefits	16	Study abroad	4
Modernization of science and technology	15	Financial support	4
Education and training	9	Title and qualification evaluation	3
Status of intellectuals	8	Encouragement	3
Human resource development	8	Scientific research management	3
Human resource mobility	8	Retirement regulations	2

At the National Science Conference held in March 1978, the principle of "respecting knowledge and respecting talent" was emphasized. Well-known remarks by Deng Xiaoping from this period—such as "Poverty is not socialism," "Development is the hard truth," "Science is hope," and "It doesn't matter whether a cat is black or white; as long as it catches mice, it's a good cat" —profoundly changed China and remain vivid in the public memory today.

University entrance examinations and overseas study programs were also reinstated. Restrictions on self-financed study abroad were lifted, and both government-sponsored and privately funded overseas education were encouraged to deepen knowledge.

In addition, the importance of intellectuals in achieving the "Four Modernizations" — the modernization of industry, agriculture, national defense, and science and technology — was repeatedly emphasized, and numerous policies were introduced to improve the treatment and living security of human resources.

In the early stages of the Reform and Opening-up period, two main strategies were implemented to address the domestic shortage of skilled personnel and promote the development of science and technology.

① Encouraging overseas Chinese professionals to return to China, and

② Supporting domestic talent to study abroad.

(2) Reform Deepening Period (1985–1994)

During this period, the main mission was to reform the management systems for science and technology personnel. To stabilize and enhance the support framework for such personnel, reforms have been implemented in the market systems, personnel systems, and agricultural science and technology frameworks.

Based on the 93 announced human resource policies, the key terms can be organized as shown in Table 4-2.

Table 4-2 Key Terms in Academic and Technical Personnel Policy and Their Frequency of Appearance in Policy

Key Terms	Frequency	Key Terms	Frequency
Science and technology system reform	55	Encouragement	12
Technology market	26	Dissemination and implementation	12
Competition mechanism	20	Science and technology-based enterprises	10
Social security	19	Science and technology funding project	10
Salary and benefits	17	Supervision	9
Education and training	17	Postdoctoral system	9
Financial support	15	Overseas talent recruitment	9
International cooperation	14	Human resource mobility	8
Title and qualification evaluation	13	Advancing agriculture with science and technology	7

Source: "Evolution, Trends, and Prospects of China's Science and Technology Talent Policies over 40 Years of Reform and Opening-Up — Based on Co-word Analysis"

The 1985 Decision on the Reform of the Science and Technology System marked the beginning of institutional reforms aimed at linking science and technology with economic development. In 1992, the transition to a socialist market economy was announced, and reforms to human resource systems followed. The introduction of a postdoctoral system and fixed-term employment schemes promoted the mobility and utilization of scientific and technological personnel.

In 1994, China launched its first talent recruitment initiative, the Hundred Talents Program, which became a forerunner of the "sea turtle policy" aimed at attracting outstanding young researchers returning from overseas. The Spark Program, initiated in 1986, aimed to modernize rural economies through science and technology.

Regarding human resource mobility, government notices and opinions issued in 1986 and 1992 encouraged the redistribution of scientific and technological personnel to appropriate positions. They promoted the transfer of researchers into practical fields through the collaboration of research institutions.

(3) Strategic Orientation Period (1995–2005)

The "Strategy of Revitalizing the Nation through Science and Education," proposed in 1995, elevated human resource initiatives to the level of national strategy. During this period, human resource development and talent recruitment programs were primarily implemented in priority areas of science and technology designated by the central government, in line with the strategy's goals. Unlike the current focus on innovation, this period was characterized by strategic, mission-oriented policies. At the time, the government focused on developing high-tech industries and began to emphasize the practical applications of scientific and technological achievements.

The key terms of the 138 human resource policies announced by the central government during this period are summarized in Table 4-3.

Since 1996, China has adopted the policy of "science and technology drive economic development," promoting reform of the science and technology system and supporting enterprises through programs such as the Science and Technology Circulation Fund and the SME Technology Innovation Fund. Additionally, the Law on the Transformation of Scientific and Technological Achievements established a system to facilitate the industrialization of research results.

In terms of human resources, following the Hundreds of Talents Program, the "Hundred Talents Program," the "Changjiang Scholars Award Program" was launched in 1998 to strengthen the cultivation and recruitment of internationally competitive academic talents. Subsequently, various initiatives such as the "High-Level Study-Abroad Returnee Support Program" and the "Hai Zhi Talent Program" were introduced. Regarding human resource mobility, the Outline of the National Talent Team Construction Plan (2002) and the CPC Central Committee Decision (2003) aimed to enhance workforce mobility through reforms of the household registration system and improvements in social security.

Table 4-3 Key Terms in Academic and Technical Personnel Policy and Their Frequency of Appearance in Policy Documents (1995–2005)

Key Terms	Frequency	Key Terms	Frequency
Revitalizing the nation through science and education	54	Dissemination and implementation	18
Science and technology-based enterprise	35	Education and training	17
High-tech technology	30	Advancing agriculture with science and technology	16
Deployment of scientific and technological achievements	28	High school	16
Supervision	26	Science fund	15
Financial support	20	International cooperation	15
Human resource development	20	Human resource mobility	13
Technological innovation	20	Strategic orientation	13
Encouragement	20	Science and technology funding project	12

Source: "Evolution, Trends, and Prospects of China's Science and Technology Talent Policy over 40 Years of Reform and Opening-up — Based on Co-word Analysis"

(4) Innovation Expansion Period (2006 onward)

Following the issuance of the 2006 Decision on Implementing the Outline of the National Medium- and Long-Term Science and Technology Development Plan and Enhancing Indigenous Innovation Capability, indigenous innovation has emerged as a key policy concept. The phrase "innovation-driven" became the central key term in talent cultivation and support policies, while "science and technology entrepreneurship" took on a leading role in promoting the application and commercialization of scientific and technological achievements.

In the 2006 policy documents "Several Opinions on Implementing an Incentive and Allocation System to Encourage Enterprises' Independent Innovation" and "Several Opinions on Mobilizing More Personnel Engaged in Science and Technology to Contribute to Building an Innovative Nation," the strategic objective shifted from "scientific and technological progress" to "scientific and technological innovation." These documents emphasize that science and technology should not only focus on economic development but should also strengthen practical applicability and cultivate an innovative mindset. Based on the 230 human resource policies issued until 2017, the extracted key terms are summarized in Table 4-4.

Table 4-4 Key Terms in Academic and Technical Personnel Policy and Their Frequency of Appearance in Policy Documents (2006–2017)

Key Terms	Frequency
Innovation-driven	142
Science and technology entrepreneurship	132
Reform of the science and technology system	109
Education and training	104
Financial support	57
Deployment of scientific and technological achievements	48
Science and technology funding project	45
Construction of scientific research platforms	43

Key Terms	Frequency
High school	36
Scientific research management	34
Human resource development	33
Human resource discovery	31
International cooperation	26
Overseas talent recruitment	24
Project collaboration	21
Human resource mobility	20

Source: "Evolution, Trends, and Prospects of China's Science and Technology Talent Policy over 40 Years of Reform and Opening-up — Based on Co-word Analysis"

Since the 2010s, China has focused on supporting entrepreneurship among scientific and technological talent and securing highly skilled human resources. The 2015 policy, "Mass Entrepreneurship and Innovation," encouraged the public at large to engage in entrepreneurship and innovation.

In terms of recruiting overseas talent, the 2008 "Thousand Talents Program" invited highly educated individuals, including foreign nationals. In 2012, the "Ten-Thousand Talents Program" was launched to cultivate domestic talent and improve the quality of researchers.

Under the Xi Jinping administration, greater emphasis has been placed on securing talent in "high-level, sophisticated, and cutting-edge" fields, as well as in "urgently needed and scarce" areas, particularly those critical to core scientific and technological domains. Against the backdrop of the U.S.–China confrontation, China has strengthened its efforts to achieve self-reliance in advanced technology by promoting the development and utilization of young researchers.

(Reference) List of Key Human Resource Initiatives in China

Start Year	Talent Program Name	Description
1985	Study-Abroad Personnel Science and Technology Activity Support Program	A program to encourage the return of students studying abroad and support expenses for scientific and technological activities conducted after their return
1994	National Outstanding Young Scientists Fund Program	A program to support individuals who have achieved excellent results or have high potential in basic research fields.
1994	CAS Hundred Talents Program	A recruitment and training policy by the Chinese Academy of Sciences emphasizing "high goals, high standards, and high intensity."
1995	National Hundreds-Thousands-Ten Thousands Talent Program	A program to cultivate young and mid-career talents capable of leading scientific and technological development, categorized by levels.
1996	Chunhui Program	A program to support short-term returns of students studying abroad to participate in China's scientific and technological work.
1997	New Century Excellent Talents Program	A program to support promising young scholars representing various academic disciplines within China.
1998	Changjiang Scholars Program	A program to recruit outstanding overseas scholars to domestic universities.
2001	Innovation Team International Cooperation Program	A program to invite Chinese scholars working abroad to the Chinese Academy of Sciences for three years to conduct joint research.
2002	High-Level Study-Abroad Returnee Support Program	A program to encourage the return of high-level overseas talents by providing 600,000 yuan in relocation support.
2004	Hai Zhi Talent Program	A program to support overseas Chinese professionals returning to work in China.
2006	Returnee Entrepreneurship Support Program	A program to support the growth of innovative, high-potential companies founded by returnees.
2008	Thousand Talents Program	A program to recruit outstanding overseas talents to China.
2009	Red Baby Program	A program to support overseas Chinese who cannot return for various reasons but can contribute to China through international cooperation.
2010	Innovation Talent Promotion Program of the Ministry of Science and Technology of the People's Republic of China	A program to establish domestic innovation bases and cultivate outstanding engineers and entrepreneurs.
2011	Youth Talent Development Program	A program to support talented individuals under 35 in fields such as natural sciences, philosophy, social sciences, and arts.
2012	Ten-Thousand Talents Program	A program to support outstanding domestic engineers and scientific-technical personnel.
2019	Foreign Experts Recruitment Program	A program to recruit high-level foreign experts to China with favorable conditions.
2021	Qiming Program	A program to recruit high-level research and entrepreneurial talents from around the world, regardless of nationality, with competitive benefits.

Source: Compiled by the author with reference to various sources.

4.2 Outline of the National Medium- and Long-term Human Resource Development Plan (2010–2020)

This plan served as a strategic roadmap for China's transition from a "nation with a large population" to a "nation strong in human resources," and it formed the foundation of subsequent human resource policies. By 2020, it aims to achieve the following goals:

1) Expansion of the overall talent pool to significantly increase the proportion of highly educated individuals in the workforce
2) Optimization of the talent structure to promote the balanced development of highly skilled workers, researchers, and managerial personnel
3) Improvement of talent quality: cultivating individuals with innovative capacity, entrepreneurial skills, and international competitiveness
4) Institutional reform: Modernize systems for human resource mobility, evaluation, compensation, and incentives.

(1) Background

Released in June 2010, the National Medium- and Long-Term Human Resource Development Plan Outline (2010–2020) was China's first comprehensive mid- to long-term human resource development plan. To ensure the sustained advancement of its economy and society, China has positioned human resources as its most vital asset. This plan aims to build a strong nation in human resources as a national strategy, striving to make China one of the world's leading countries in both the quality and quantity of talent by 2020. This document provides the detailed goals and measures for talent cultivation by 2020.

(2) Goals by 2020

With the guiding principles of "human resources supporting the development of science and technology, prioritizing talent above all else, making full use of human potential, securing innovative and high-level personnel, and promoting human resource development across a wide range of fields," China aims to expand its talent pool by 2020 and transform itself into a nation strong in human resources. Specifically, by 2020, the total number of personnel supporting scientific and technological development will increase to 180 million, with 20% of the workforce receiving higher education and 28% of skilled workers classified as having a high-level technical talent. The plan also sets targets for investment in human resources to reach 15% of Gross Domestic Product (GDP), with human resources contributing 33% to economic growth and talent contributing 35%.

(3) Mission in Human Resource Development

Mission	Detailed Content
Cultivation of high-level innovative science and technology talent	• Training method: Build new human resource development models by combining school education with practical training and linking domestic cultivation with international exchange. • Implementation programs: Secure outstanding talent from home and abroad through programs such as the Changjiang Scholars Program and the National Science Fund for Distinguished Young Scholars (NSFC). • Institutional measures: Strengthen system reform, personnel evaluation, and incentive mechanisms. • Targets: ▼ R&D personnel: 3.8 million ▼ High-level innovation talent: 40,000
Cultivation of "Urgently Needed and Scarce" talent in key areas of social development	• Target fields: Machinery, IT, biotechnology, new materials, aerospace, marine, finance, environmental protection, energy, transportation, agriculture, etc. • Objective: Focus on developing talent urgently needed but currently lacking in these sectors. • Target: Train over 5 million people by 2020.
Cultivation of corporate management talent	• Objective: Strengthen the international competitiveness of Chinese enterprises and support their overseas expansion. • Target group: Management personnel with both professional expertise and a global perspective. • Target: Train 40,000 people by 2020.
Cultivation of professional and technical talent	• Objective: Expand the pool of technical talent equipped with innovation ability and competence to meet modernization needs. • Focus: Give priority to "high-level" and "urgently needed and shortage" talent. • Target: 75 million by 2020. • Composition ratio goal: Senior 10%, Intermediate 40%, Junior 50%.
Cultivation of high-level skilled talent	• Objective: Address the shortage of engineers and skilled technicians to meet industrial upgrading demands. • Targets (by 2020): ▼ Skilled personnel: 39 million ▼ Among them, high-level skilled personnel: 10 million
Cultivation of practical talent in rural areas	• Objective: Develop human resources capable of managing and producing to support new rural construction. • Target: Train 18 million people by 2020.

(4) System and Mechanism Innovation

Key Point	Included Content
Improvement of the human resource management mechanism	• Goal: Eliminate administrative interference and strengthen the autonomy of each organization. • Method: Shift to an open and transparent management system, enabling organizations to make autonomous decisions in talent selection, utilization, and management.
Strengthening legal protection for talent	• Goal: Safeguard the rights, interests, and safety of talents. • Method: Promote the development and improvement of laws and regulations governing talent market management, cultivation, recruitment, utilization, and supervision.
Improvement of the talent evaluation mechanism	• Goal: Achieve fair evaluation based on performance and competence. • Method: Shift from traditional evaluation focused on academic background and publications to new criteria emphasizing work capability and contribution.
Improvement of the talent appointment and promotion mechanism	• Goal: Ensure appropriate placement of talents in suitable positions. • Method: Introduce open and competitive selection systems to ensure reliable appointments. Implement term-based systems for party and government leaders, and use global recruitment mechanisms to select key project leaders.
Improvement of human resource mobility and allocation mechanism	• Goal: Promote fair competition among market entities and encourage free career choice. • Method: Under the government's macro-level regulation, build a human resource mobility mechanism in which market entities compete, and intermediary institutions provide necessary services.
Improvement of talent incentive and security mechanism	•Goal: Ensure that talent is rewarded fairly in accordance with their performance and contribution. • Method: Improve the distribution, incentive, and security systems to establish a fair and dynamic compensation structure. In addition, strengthen social security (pension and medical insurance) and improve the overall talent protection system.

(5) Implementation of Major Human Resource Programs

By 2020, the plan aims to implement the following 12 talent programs to foster outstanding human resources.

Program Name	Description
Innovation Talent Promotion Program	A program to cultivate world-class scientists to strengthen international competitiveness.
Youth Talent Development Program	A program to nurture young talents in natural sciences, philosophy, and social sciences, culture, and the arts.
Corporate Management Talent Quality Improvement Program	A program to develop management professionals with expertise in finance, human resources, accounting, and law to enhance corporate international competitiveness and modern management capabilities.
High-Quality Education Talent Training Program	A program to foster outstanding teachers through training, academic exchange, and funding project support.
Cultural Master Program	A program that supports talented individuals in journalism, publishing, broadcasting, media, and the arts to engage in creative and research activities, exhibitions, and publications.
National Health and Hygiene Talent Support Program	A program to support and train excellent physicians.
Foreign Experts Recruitment Program	A program to recruit global talents in science and technology who can contribute to breakthroughs in technology and the development of high-tech industries in China.
Professional and Technical Talent Knowledge Renewal Program	A program to develop professional and technical talents in advanced manufacturing, information technology, biotechnology, new materials, marine science, finance and accounting, environmental protection, energy resources, transportation, and agricultural technology.
National High-Level Skilled Talent Development Plan	A plan to cultivate one million high-level skilled workers by 2020.
Modern Agriculture Talent Support Program	A program to support individuals who can engage in technology dissemination, technical exchange, and training in rural areas.
Talent Support Program for Impoverished Regions	Programs to support teachers, doctors, and scientific and technical personnel working in impoverished, remote, and former revolutionary base areas.
University Graduate Rural Revitalization Program	Programs to support university graduates who work in rural areas, offering benefits such as tuition waivers and student loan forgiveness.

4.3 Human Resource Development under the 14th Five-Year Plan (2021–2025)

Human resource development, under the 14th Five-Year Plan, focuses on securing talented individuals capable of meeting the demands of industrial advancement and technological innovation. By promoting innovation in the education system, enhancing international exchange, and facilitating human resource mobility, this plan aims to cultivate a highly competitive workforce. Comprehensive measures are being strengthened to nurture globally competitive science and technology talent and promote innovation and entrepreneurship.

The Outline of the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China, released in 2021, is the most important policy for the 2021–2025 period. This plan emphasizes that in China's modernization process, scientific and technological self-reliance and self-strengthening serve as a strategic pillar of national development, and that it is essential to implement both the "strategy for building a strong nation through talent" and the "innovation-driven development strategy." Recognizing that the advancement of science and technology depends on human talent, Chapter 6, titled "Stimulating the Vitality of Talent and Innovation," highlights the following key points regarding human resource development.

Table 4-5 Key Points on Human Resource development under the 14th Five-Year Plan

Goal	Focus	Measures
Development of high-level human resources	Cultivate science and technology talent with international competitiveness.	• Foster world-class, strategically important science and technology professionals. • Nurture a reserve force of young science and technology talent. • Focus on identifying and training talent for major scientific and technological missions. • Strengthen the cultivation of innovative, application-oriented, and skilled personnel. • Develop outstanding students in fundamental disciplines (mathematics, physics, chemistry, biology). • Attract top domestic and international talent to build key positions in scientific research and innovation. • Establish systems such as residence, taxation, and social security for foreign high-end talent to create an internationally competitive environment.
Encouraging and maximizing the effectiveness of talent	Enhance motivation and generate effective outcomes.	• Establish evaluation systems emphasizing innovation capacity, quality, and contribution. • Build profit-sharing mechanisms based on knowledge and technology. • Promote leading talents and grant them authority over technical decisions and budget usage. • Grant researchers greater autonomy and promote a "green channel" (streamlined administrative processes). • Grant rights and long-term usage of scientific achievements and increase profit-sharing ratios. • Deepen reform of the academic system.
Optimization of the innovation, entrepreneurship, and creative ecosystem	Promote innovation and entrepreneurship culture while strengthening scientific ethics.	• Promote the spirit of scientists and establish a comprehensive system of scientific ethics. • Legally protect entrepreneurs' property rights and innovation gains. • Optimize the layout of "Mass Entrepreneurship and Innovation" bases. • Foster an innovation and entrepreneurship culture emphasizing tolerance toward failure. • Enhance young people's interest in science and improve their scientific competence. •Emphasize human resource development in the fields of cybersecurity, as well as in rural, western, and border regions.

4.4 Action Plan for Accelerating Digital Talent Development and Supporting Digital Economy Growth (2024–2026)

This is an action plan launched to foster and recruit digital talent, which remains insufficient compared with the ever-growing scale of the digital economy. This plan presents the missions and policy initiatives aimed at developing a large number of digital professionals.

(1) Background

In April 2024, the Ministry of Human Resources and Social Security, together with eight other government departments, issued the "Action Plan for Accelerating Digital Talent Development and Supporting Digital Economy Growth." This plan aims to ensure that digital talent underpins the digital economy, drives high-quality development, and builds long-term capacity. Over approximately 3 years, the plan seeks to promote initiatives to cultivate, attract, retain, and utilize digital talent, thereby enhancing independent innovation capabilities and revitalizing the overall digital talent ecosystem.

As of the end of 2022, China's digital economy reached 50.2 trillion yuan, accounting for 41.5% of the country's GDP. In recent years, the Chinese government has highlighted several pressing issues, including a "shortage of digital talent," a "mismatch between talent and industry needs," and "insufficient innovation capacity in key core areas." It is estimated that China faces a shortage of approximately 25–30 million digital professionals, even with conservative calculations.

This action plan presented six key missions along with the corresponding policy initiatives to achieve them.

(2) Six Key Missions

Mission	Main Content
Systematic development of digital technology engineers	• Formulate national-level occupational standards (by specialty and skill level) for fields such as big data, AI, smart manufacturing, and data security. • Conduct specialized technical training and issue technical certificates to qualified participants.
Enhancement of digital skill talent	• Focus on cultivating practical and advanced skills for professionals in response to industry needs. • Establish a consistent training system from schools to enterprises. • Promote adoption of the new "Eight-Level System" (eight-grade professional skill classification).
Strengthening international talent exchange	• Recruit high-level overseas talent and support returning overseas students in entrepreneurship. • Promote digital talent exchanges within the "Belt and Road" framework. • Develop core personnel with an international perspective.
Reinforcement of innovation and entrepreneurship support	• Promote the establishment of support institutions such as entrepreneurship academies. • Strong support for entrepreneurship in fields such as AI, smart manufacturing, and e-commerce. • Development of "Specialized, Sophisticated, Distinctive, and Innovative" SMEs. • Establishment of incubators and industrial parks in major cities.

Expanding opportunities for engagement and supporting career development	• Creation of tailor-made training programs based on corporate needs. • Cultivation of multi-skilled talent specializing in the integration of digital technology and industry. • Expansion of postdoctoral mobility stations and learning support at continuing education and excellence training centers.
Identifying talent through technology competitions	• Introduction of new competition categories—such as integrated circuits (ICs), AI, data security, and smart manufacturing—at the National Skills Competition. • Promotion of commercialization of outstanding achievements from the Postdoctoral Entrepreneurship Competition through collaboration with key national projects.

(3) Policy Initiatives

Point	Specific Measures
Human resource development support	• University department reform and establishment: Establish new departments and interdisciplinary graduate schools in digital fields. • Reform of vocational education institutions: Improve educational quality and promote digital transformation by creating new digital-related programs. • Strengthening industry–academia–research collaboration: Promote the development of multi-skilled digital professionals through cooperation among educational institutions, research organizations, and companies.
Development of evaluation systems	• Adjustment of digital occupations: Increase new positions aligned with the times, such as AI, ICs, and big data. • Improvement of the occupational evaluation system: Establish occupational standards and evaluation criteria for the digital economy sector, and improve related qualification systems. • Alignment with international standards: Enhance the evaluation system for outstanding digital engineers to gain global recognition.
Improvement of the allocation system	• Performance-based compensation: Provide capable personnel with remuneration commensurate with their abilities and achievements. • Digital economy talent compensation guidelines: Ensure appropriate pay levels and implement cash bonus systems.
Expansion of financial investment	• Creation of dedicated funds: Establish funds to cultivate digital talent. • Expansion of corporate investment: Increase corporate investment in digital talent development, with government support for related expenses. • Training management: Record implemented training programs in an information management system and provide allowances to participants.
Support for workforce mobility in enterprises	• University collaboration: Create flexible digital talent positions at universities and support industry professionals in holding concurrent posts.
Development of an environment for talent recruitment	• Regional support: Recruit promising talent by addressing issues such as household registration (hukou), children's education, and spouse employment assistance. • Securing a digital talent pool: Build systems and environments to secure and utilize digital professionals in local regions.

4.5 Evaluation of Human Resource Policies

China's human resource policy is positioned at the core of the nation's long-term development strategy, with a particular focus on cultivating and securing highly skilled personnel to support the development of a strong science and technology nation. Since the Reform and Opening-up, China has gradually developed a comprehensive human resource development system, and following the adoption of the "Strategy for Strengthening the Nation through Talent," it has further strengthened talent recruitment and training policies linked to key national projects.

(1) Achievements

Beginning with the launch of the Thousand Talents Program (Overseas High-Level Talent Recruitment Program) in 2008, China focused on recruiting talent from abroad through initiatives such as the Ten-Thousand Talents Program, Young Thousand Talents Program, and the Changjiang Scholars Program. These policies have achieved notable results by encouraging Chinese scientists with educational and research experience in the U.S., Europe, and Japan to return to China, thereby enhancing the nation's R&D capacity. Systems for fostering young researchers have been established domestically, primarily at leading universities and research institutions, alongside expanded opportunities for competitive research funding and academic positions.

One achievement is that the concentration of highly skilled human resources has strengthened the nation's fundamental research capabilities and enhanced its international presence in advanced fields such as quantum information science, AI, biomedical engineering, and aerospace. The recent increase in citations of Chinese scientific papers is considered an indicator of policy effectiveness. A 2023 survey found that the number of highly cited papers from China, excluding international coauthorships, surpassed that of the U.S., suggesting a degree of qualitative improvement in research outcomes.

(2) Challenges

However, several challenges must be overcome. First, the centralized nature of the system and its excessive focus on targets have been criticized for creating rigidity and bureaucratic management in research activities. The personnel evaluation system still partly relies on the number of publications and academic titles, increasing the risk of prioritizing short-term results and immediate impacts over long-term, exploratory research. In addition, some government talent recruitment programs have been identified as resulting in duplication of investment or "nominal appointments," in which researchers are invited in name only without substantive improvement in research quality.

Furthermore, the framework for supporting the career development of young researchers remains underdeveloped. For example, with the increase in fixed-term positions, it often takes a long time to obtain a stable research environment—a situation known as the "postdoctoral bottleneck." In addition, there are growing concerns regarding the mental burden caused by intensified competition for promotion and research funding. Moreover, significant disparities in research environments persist between urban and rural areas, as well as between coastal and inland regions, and the regional imbalance in human resources remains unresolved.

To address these challenges, the Chinese government revised and upgraded its human resource policies during the 14th Five-Year Plan period (2021–2025). In particular, new principles have been introduced in the cultivation, evaluation, and utilization of scientific and technological talent, emphasizing "representative achievements," "contribution-based evaluation," and "diversified incentives." Since 2023, pilot programs have been launched to provide targeted support for young scientists under 35 and to expand personnel management autonomy in universities and research institutions. Furthermore, efforts are underway to create a more attractive research environment for female and foreign researchers by promoting greater diversity within institutional structures.

However, despite more than 10 million university and graduate school students graduating and entering society each year, the youth unemployment rate has reached a record high, indicating severe employment difficulties among younger generations.

1) The Reasons Why the Employment Difficulty for Young People Is Serious

According to the author's analysis, the factors contributing to employment difficulties among young people can be summarized as follows:

Cause	Description
Oversupply: Rapid increase in university graduates	As a result of the Chinese government's higher education expansion policy ("popularization of higher education") pursued for over 20 years, the number of new graduates reached about 11.5 million in 2023. However, the job market for university graduates has not kept pace, leading to a mismatch between academic qualifications and available positions.
Mismatch between industrial structure and workforce demand	The national economy is in transition from manufacturing to high-tech and service industries. Meanwhile, the job types young people seek (white-collar, IT, government, research, etc.) are in limited demand. In particular, strengthened regulations on platform economies (e.g., Alibaba, Tencent) and restrictions on the education and real estate sectors have reduced workforce demand in industries that once employed many young workers.
Slowing economic growth and corporate hiring restraints	Recovery from the zero-COVID policy has not progressed as expected, leading to a decline in private companies' confidence in government policy and their willingness to invest. Consequently, private firms—particularly SMEs—tend to refrain from hiring new graduates.
Regional disparities and urban-oriented preferences	Many young people hope to find employment in first-tier cities such as Beijing, Shanghai, Guangzhou, and Shenzhen, but the competition there is extremely intense. Although job opportunities are relatively abundant in regional areas, they are often avoided. Moreover, due to restrictions under the household registration (hukou) system, it remains difficult for people from rural areas to secure stable employment in urban centers.

In addition, recent generations tend to place greater importance on "compensation, job fulfillment, and urban lifestyle," showing a reluctance to work in rural areas, manufacturing, or manual labor. Phenomena such as tǎng píng ("lying flat") and màn jiù yè ("slow employment," or delaying job hunting) symbolize a decline in work motivation and a shift in attitudes toward job quality. Furthermore, with a growing preference for job stability, an increasing number of young people are aspiring to become civil servants (kǎo gōng) or employees of state-owned enterprises (kǎo biān). Consequently, competition for certain positions has intensified, leading to an overheated job market. In the 2023 national civil service examination, more than three million people applied, with some positions attracting over 100 applicants per opening.

2) Why the "Mismatch Problem" Persists Despite Government Policies and Measures

Although the Chinese government has taken measures to improve the employment difficulties faced by young people caused by the various factors mentioned above, the problem of job mismatch remains unresolved. This persistence can be attributed to several factors.

Point	Details
Many policies exist, but they fail to address "quality" or "structural" issues.	The government has launched initiatives such as the Employment Promotion Month, One Million Jobs Creation Plan, and various employment subsidies. These contributed to a temporary increase in the number (quantity) of jobs, but did not provide a fundamental solution. The core issue lies in the mismatch between "jobs young people want" (urban, white-collar) and "jobs the market demands" (regional, manufacturing, on-site), resulting in limited effectiveness against structural supply–demand gaps.
Gap between university education and industrial needs	University curricula remain heavily academic and theory-oriented and do not align with the practical skills demanded by industries such as AI, data analytics, and field operations. Some humanities faculties remain popular among students despite limited career prospects. Although the government is promoting reforms in university major structures, the impact will take time to emerge.
Incentive structure reinforces preference for job stability	Interest in civil service and state-owned enterprises remains high. As part of employment stabilization measures, the government has expanded recruitment in the state sector. Consequently, more students aim for secure positions in government or large corporations, while mobility toward private firms, startups, and local SMEs has declined.
Weakness of local economies and strong urban preference among youth	Although the government promotes entrepreneurship and employment in local areas through subsidies and startup support, young people continue to prefer urban lifestyles. Given that attractive living conditions and social security systems are concentrated in cities, regional relocation policies are less effective. Moreover, the hukou (household registration) system still poses major barriers to access to residence, childcare, and healthcare in cities.
Insufficient recovery of private-sector employment capacity	Ongoing economic uncertainty has weakened hiring intentions, particularly in the IT, real estate, and education sectors. Even with government encouragement to expand private employment, companies remain hesitant to hire without a stable and confident economic environment.
Gap between youth "expectations" and "reality"	As higher education expands, the gap between young people's self-evaluations and actual job-market conditions has widened. Many graduates are reluctant to take on field or manual work, believing such jobs are "unsuitable" for them, thereby missing out on available positions.

In the field of international exchange, the growing U.S.–China rivalry and rising geopolitical risks have created barriers to the inflow of foreign talent and joint international research. However, the Chinese government has indicated its intention to accelerate the development of an independent research environment, thereby reducing its reliance on foreign countries while selectively maintaining collaboration with strategic partners. This approach can be regarded as laying the foundation for a model of "self-reliance and self-strengthening" of human resource policy.

Human resource policies in China have achieved remarkable success in a short period, fostering talent both in quantity and quality and contributing significantly to the enhancement of national technological capacity. However, from a long-term sustainability perspective, challenges remain in institutional operations, the lack of diversity and flexibility in research environments, and the impact of international conditions. In the future, it will be essential to design systems that respect researchers' creativity and freedom while balancing competition and supporting toward truly innovative human resource policies.

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5 Basic Research

5.1 Evolution of Basic Research Policy

This chapter introduces the policies for promoting basic research under the Xi Jinping administration. Before doing so, it is necessary to review the evolution of China's basic research policies and the policies related to higher education institutions responsible for conducting basic research.

Basic research policy in China is closely tied to national development strategies and has become a crucial element in supporting recent economic growth and technological innovation. China recognizes that the advancement of science and technology is directly linked to national strength and has therefore strengthened its support for basic research.

(1) Early Basic Research Policy (1949–1970s)

After the founding of the People's Republic of China **(PRC),** early science and technology policies were largely based on the Soviet model, and basic research was regarded as essential for building the foundations required for national economic growth. From the 1950s to the 1960s, the central government promoted the establishment of state-owned research institutes to advance scientific and technological development, with a particular emphasis on theoretical research. However, the Great Leap Forward (1958) and the Cultural Revolution (1966–1976) caused significant stagnation in basic research, and many research institutes and universities became disorganized. During this period, growth in basic research remained extremely limited.

(2) Reform and Opening-Up and the Revival of Basic Research (1980s–1990s)

After Deng Xiaoping launched the Reform and Opening-Up policy in 1978, China entered a period of rapid economic growth and recognized that the promotion of science and technology was essential for national development. During this period, basic research began to receive government support. In the 1980s, the basic research system was reorganized, academic and research institutions were reformed, and international cooperation advanced. The National Medium- and Long-Term Plan for Science and Technology Development announced in 1985 marked a major turning point in China's science and technology policy and emphasized the importance of basic research. In 1986, the National Natural Science Foundation of China (NSFC) began providing full-scale funding for basic research. This foundation aims to promote the autonomous development of basic research by providing competitive funding to academic institutions and researchers.

(3) High-Growth Phase and the Deepening of Technological Innovation (2000s–2010s)

In the 2000s, China, now the world's second-largest economy, began pursuing advanced technological development. The Medium- and Long-Term Plan for the Development of Science and Technology (2006–2020), released in 2006, identified the construction of an "innovation-oriented nation" as a national strategy and clearly positioned basic research as its core foundation. This plan emphasizes increasing funding for basic research, expanding the autonomy of research institutions, and promoting international collaborative research.

In 2008, under the framework of the 17th Five-Year Plan, national R&D expenditures surged, with a particularly large increase in the budget for basic research. The government also strengthened universities—the core foundation for basic research—through major national programs such as "Project 985" and "Project 211."

(4) Recent Policies on Basic Research

In the 2010s, basic research was given greater importance, and the strategic direction of the national science and technology policy became more clearly defined. Under the Xi Jinping administration, initiatives such as Made in China 2025 and the Innovation-Driven Development Strategy have positioned the strengthening of basic research as a top national priority. The National Medium- and Long-Term Plan for the Development of Science and Technology (2020–2035), released in 2016, emphasizes the deepening of basic research and calls for more long-term and sustained support.

Particular attention has been directed toward strengthening basic research in cutting-edge fields such as AI, quantum communication, biotechnology, and semiconductor technology. These areas are expected to serve as the foundation for the next generation of technological innovations, and the government has devoted substantial funding and resources to their research.

Furthermore, the internationalization of basic research has advanced, leading to more active collaboration with overseas research institutions. China aims to raise its research standards within the global scientific community by strengthening its cooperation and participation in international research frameworks.

5.2 Changes in University Policy

(1) Resumption of University Entrance Examinations after the Founding of the PRC

The development of higher education in China after the founding of the PRC was heavily influenced by the political and economic conditions of each era. When the PRC was established in 1949, the government judged that the limited number of higher education institutions could not supply sufficient human resources, and in 1952 it implemented the "University Faculty Restructuring," modeled after the Soviet system. This reform aimed to rapidly cultivate the large number of technical specialists needed for national reconstruction. Between 1954 and 1960, 44 key universities were selected nationwide and received government support. However, the Great Leap Forward, which began in 1958, and the subsequent Cultural Revolution severely damaged higher education institutions, resulting in a period of disruption and exhaustion.

After the Cultural Revolution, the unified national university entrance examination was reinstated in 1977 under Deng Xiaoping's leadership, making university entrance the most important path for young people in China. With this reinstatement, the higher education system returned to its normal trajectory. The number of examinees began to increase in 1985, reaching 10.5 million by 2008. The total number continued to rise, reaching 13.53 million by 2024.

(2) "Project 211" and "Project 985"

In 1995, the government launched Project 211, with the objective of establishing more than 100 key universities across the country in the twenty-first century and improving their academic disciplines, public service systems, and campus environments. This project emphasized developing priority disciplines to raising some fields to levels approaching the global frontier. Consequently, the academic standards of designated universities improved, and China's higher education system was strengthened.

In 1998, Jiang Zemin announced Project 985, a national initiative to build world-class universities. This project prioritized support for the country's top institutions, with the goal of elevating the quality of research and education to international standards. Through this initiative, universities such as Peking University and Tsinghua University rose in global university rankings and gained strong international recognition. By 2000, these universities became globally known, and by 2011, 20 Chinese universities had appeared in world rankings.

(3) "Double First-Class University Initiative"

To reduce disparities in higher education, the government introduced the Double First-Class University Initiative in 2015. This initiative aims to develop world-class universities and academic disciplines, with the goal of elevating a selected group of universities and disciplines to world-leading status by 2020. By 2030, a larger number of institutions and disciplines are expected to reach the top global tier, and by 2050, China aims to become a major power in higher education. In 2019, "Project 211" and "Project 985" programs were consolidated and reorganized into the new Double First-Class framework, under which universities are ranked based on periodic evaluations.

The Chinese government has commissioned third-party agencies to evaluate all universities in the following areas: talent cultivation, scientific research (including basic research, applied research, and humanities and social sciences), contributions to society (including industry–university collaboration), preservation and promotion of Chinese culture, development of faculty and research teams, and international cooperation. Based on these assessments, institutions were designated as "First-Class Universities" and specific fields were designated as "First-Class Disciplines." Within the "First-Class University" category, there are A-level and B-level designations. During the five-year evaluation cycle, institutions may be downgraded from A to B or lose their B-level status if they fail to meet required standards. As of January 2025, the list includes 42 universities, as shown in Table 5-1.

Table 5-1 42 universities in "First-Class University" category

A-level Universities (36): Peking University, Renmin University of China, Tsinghua University, Beijing University of Aeronautics and Astronautics, Beijing Institute of Technology, China Agricultural University, Beijing Normal University, Minzu University of China, Nankai University, Tianjin University, Dalian University of Technology, Jilin University, Harbin Institute of Technology, Fudan University, Tongji University, Shanghai Jiao Tong University, East China Normal University, Nanjing University, Southeast University, Zhejiang University, University of Science and Technology of China, Xiamen University, Shandong University, Ocean University of China, Wuhan University, Huazhong University of Science and Technology, Central South University, Sun Yat-sen University, South China University of Technology, Sichuan University, Chongqing University, University of Electronic Science and Technology of China, Xi'an Jiaotong University, Northwestern Polytechnical University, Lanzhou University, National University of Defense Technology
B-level Universities (6) Northeastern University (China), Zhengzhou University, Hunan University, Yunnan University, Northwest A&F University, Xinjiang University

In China, where great emphasis is placed on elite education, enhancing university visibility has become an essential mission that no institution can afford to neglect. Since the launch of the Double First-Class University Initiative, this mission has become even more important. Universities designated as first-class institutions receive financial support from both central and local governments, which is also a significant factor.

With the advancement of the Double First Class Initiative, Chinese universities have made remarkable progress in global university rankings. In the QS World University Rankings 2025, 71 Chinese universities were ranked, including Peking University at 14th and Tsinghua University at 20th. In the THE World University Rankings 2025, Chinese institutions also performed strongly, with 94 universities ranked, led by Tsinghua University at 12th and Peking University at 13th.

5.3 Several Opinions of the State Council on the Comprehensive Strengthening of Basic Scientific Research (2018)

This document was issued as the Xi Jinping administration advanced its innovation-driven development strategy, recognizing that delays in basic research became a major bottleneck. It presents measures to enhance the quality and quantity of basic research and fundamentally strengthen China's indigenous innovation capability. This opinion reaffirms the importance of basic research and establishes strategic directions for its reinforcement.

(1) Main Point

In January 2018, the State Council released several opinions on the comprehensively strengthening of basic scientific research. As stated in the preface, major advanced countries worldwide are uniformly enhancing their strategic planning for basic research. As global, scientific, and technological competitions shift toward basic research, China exhibits a pronounced weakness in basic scientific research relative to the requirements for building a world-class science and technology power. Fundamental disciplines, such as mathematics, remain the weakest areas, and the number of highly original research is limited. This document was formulated to address these issues.

(2) Policy Goals for Basic Scientific Research

The Chinese government has presented a three-stage set of goals to be achieved through strengthening basic scientific research.

- **By 2020**, China should enhance its international standing in basic research, join the world's leading groups in major fields, and support the realization of an innovation-driven nation.
- **By 2035**, China is expected to lead the world in a greater number of fields, generate major original breakthroughs, and solidify the foundation for modernization.
- **By the middle of this century**, China is expected to be established as a global hub for science and innovation, cultivate top-level scientists, and become a world-class power in science and technology.

(3) Main Policy

Summary	Content
Strengthening the Strategic Position of Basic Research	• Emphasize basic research as the foundation of the national innovation system. • Build a long-term and stable support framework.
Diversification and Sustainability of Funding	• Strengthen fiscal support from central and local governments. • Promote investment from enterprises and the private sector.
Reform of Research Systems and Mechanisms	• Integrate basic research into national key R&D programs and provide focused support. • Reform management systems to respect the autonomy of research institutes and universities and foster creativity.
Human Resource Development and Improvement of the Research Environment	• Prioritize the training and appointment of outstanding young researchers. • Actively attract talent from overseas.
Strengthening International Cooperation	• Enhance collaboration with global research networks and increase international presence.
Improvement of Research Evaluation Systems	• Shift toward evaluation systems that emphasize long-term contributions. • Correct the tendency to overvalue short-term results.

(4) Key Point

Measure	Content
Priority Allocation in Basic Research	• Strengthen fundamental disciplines (mathematics, physics, etc.) with an emphasis on education. • Take the lead in frontier fields such as space, matter, life, and brain science, as well as quantum, brain, and deep-sea science.
Development of Research Infrastructure	• Restructure and reinforce national laboratories and key laboratories in line with national strategies. • Establish interdisciplinary research centers in collaboration with universities and enterprises.
Strengthening Human Resource Development	• Promote the cultivation of high-level talent (e.g., the Thousand Talents Program and the Ten Thousand Talents Program), improve postdoctoral systems, and develop practice-oriented professionals to optimize research teams.
Promotion of Internationalization	• Advance China-led international big-science projects and deepen international innovation cooperation under the Belt and Road Initiative.
Improving the Development Environment	• Build a diversified investment and long-term stable support system and establish flexible project management mechanisms. • Promote integration among basic research, applied research, and industrialization to advance fusion-type innovation.

5.4 Guidelines to Enhance “0-to-1” Basic Research (2020)

This policy document differs from previous measures in that it explicitly promotes basic research. The phrase “0-to-1” reflects its aim to fundamentally strengthen the nation's capacity to generate primordial innovation. To achieve scientific and technological self-reliance and self-strengthening, the guidelines include measures to enhance the quality and originality of basic research, encourage free exploration, and ensure academic freedom and long-term research continuity.

(1) Main Point

In March 2020, five ministries led by the Ministry of Science and Technology released the Guidelines for Strengthening Basic Research Activities that Create “0-to-1.” The term “from 0 to 1” was introduced for the first time in this policy. The central concept throughout the document is to strengthen basic research that generates “0-to-1” breakthroughs, opens up new fields, proposes new theories, develops new methodologies, and achieves major, pioneering, and innovation-enabling scientific outcomes. The objective is to prevail in international competition in the new wave of technological and industrial transformation and to become a global powerhouse in science and technology.

(2) Basic Principles

The guidelines emphasize deepening human-centered reforms, optimizing the research environment, providing stable support, and strengthening innovation governance to achieve breakthroughs in major scientific questions and key and core technologies. The aim is to promote originality in basic research, stimulate researchers' innovative drive, and generate significant and original scientific achievements, thereby providing strong foundational support for building China into a leading global power in science and technology.

(3) Key Point

Field	Content
Institutional Framework	• Build an evaluation system that prioritizes originality and academic contribution over the number of publications or academic titles. • Support universities and research institutes in independently designing research programs. • Promote international cooperation and foster academic freedom and a healthy research culture.
Funding	• Strengthen priority support for basic disciplines (mathematics, physics, etc.) through the NSFC. • Under national key programs, emphasize investment in original innovation and core technologies. • Promote long-term and forward-looking support based on global technological trends.
Human Resource Development	• Grant decision-making authority (e.g., budget, team composition) to leading researchers. • Support long-term projects led by young researchers in their 30s and 40s. • Prioritize the development of researchers under the age of 35.
Research Infrastructure & Environment	• Promote the development and industrialization of advanced scientific instruments and equipment. • Improve research infrastructure—including data, materials, and tools—to strengthen original research capabilities.

In 2021, the Law on Scientific and Technological Progress was amended, and a new chapter on basic research was established. As this has already been described in "2.7 Amendment of the Law on Scientific and Technological Progress (2021)," it is omitted here.

5.5 Emerging Policies for Basic Research in the Government Work Report (2024)

(1) Role of the Report

The Government Work Report is an important document that reviews achievements from the previous year and presents policy objectives for the current year. It reflects on the government's work over the past year, summarizes its accomplishments and challenges, and sets forth goals and policy directions for the new fiscal year.

(2) Key Achievements in 2023

Field	Achievement
Economic Growth	• GDP exceeded 126 trillion yuan, up 5.2 % year-on-year, ranking among the highest globally.
Science & Technology	• Breakthroughs in aviation engines, nuclear reactors, artificial intelligence, and quantum technology. • Technology contract value increased by 28.6 %.
Industrial Development	• The large passenger aircraft C919 completed its first flight, and a domestically built cruise ship was successfully constructed. • New-energy vehicles accounts for more than 60 % of the global market share.
Industrial Integration	• Deepening advanced integration between manufacturing and services.

(3) Main Challenges

・Pressure on local government finances and delayed industrial growth
・Employment mismatches and inadequate public services
・Insufficient capacity for science and technology innovation

(4) Main Targets for 2024

・GDP Growth Rate: Around 5 %
・New Urban Jobs: More than 12 million
・Unemployment Rate: Approximately 5.5 %
・Consumer Price Inflation: Around 3 %
・Household Income: To grow at the same pace as economic growth
・Grain Production: Over 650 million tons
・Energy Efficiency: Reduce energy consumption per unit of GDP by approximately 2.5 %

(5) Key Priorities for Strengthening Basic Research

Point	Measures
Strengthening the Position of Basic Research	• Accelerate the nation's capacity for independent scientific and technological development. • In accordance with national strategies and industrial needs: (1) plan basic research systematically, and 2) provide long-term, stable support for key fields. • Reinforce research on disruptive and frontier technologies.
Human Resource Development and Utilization	• Develop talent hubs and attraction platforms. • Strengthen the training and support of young and outstanding researchers. • Promote international exchange and establish performance- and competence-oriented talent evaluation systems. • Enhance living conditions, research support, and incentive systems.

5.6 Evaluation of Basic Research Policy

In recent years, China has vigorously advanced its national development through science and technology, and has strengthened basic research as a core component of its policy agenda. Particularly since the launch of the 14th Five-Year Plan (2021–2025), which emphasizes "self-reliance and self-strengthening through science and technology," the government has implemented concentrated measures across multiple areas, including institutional development for basic research, financial investment, talent cultivation, and systemic reform. In the 2024 Government Work Report, basic research is designated as a strategic priority and is clearly recognized as a critical pillar shaping the nation's overall competitiveness.

(1) Achievement of Target Indicators

To what extent have the goals presented in various policies been achieved? Regarding the increase in research and development (R&D) expenditures, the 14th Five-Year Plan (2021–2025) set a target of achieving an average annual growth rate of more than 7 %. In 2024, China's R&D spending reached 3.613 trillion yuan, representing an 8.3 % increase from the previous year and accounting for 2.68 % of GDP. Notably, spending on basic research rose from 10.5 % to 249.7 billion yuan, representing 6.91 % of total R&D expenditure.

For the goal of increasing the share of basic research, the government aimed to raise the proportion of basic research within overall R&D to at least 8 % by 2025. As of 2024, the share stands at 6.91 %, indicating steady progress toward this target.

Significant scientific and technological advances have also been reported as a result of strengthened basic research initiatives:

- Space exploration: The Chang'e-6 lunar probe successfully completed the world's first sample-return mission to the far side of the Moon.
- Quantum technology: China succeeded in constructing a quantum simulator capable of surpassing classical computers in specific tasks.
- Meteorological and marine technology: China completed its next-generation meteorological supercomputing system and commissioned the domestically designed deep-sea drilling vessel Mengxiang ("Dream").

(2) Achievements

The comprehensive promotion of basic research has produced notable results in several key fields. China has achieved research outcomes that have attracted international attention in areas underpinning next-generation science and technology, such as quantum information, artificial intelligence, brain-inspired computing, and synthetic biology. For example, the quantum communication satellite Micius and the development of a quantum-network experimental city have generated significant spillover effects for applied research. In addition, the first commercial flight of the domestically produced large passenger aircraft, C919, and China's attainment of a 60 % share of the global new-energy vehicle market can be viewed as the combined result of basic and applied research.

In terms of institutional development, reforms in evaluation and support systems are progressing. The Guidelines to Enhance "0-to-1" Basic Research, released in 2020, emphasized originality and proposed establishing evaluation mechanisms that do not rely excessively on publication counts or academic titles. Simultaneously, reforms to the NSFC have advanced as funding mechanisms for basic research, promoting exploratory research with academic freedom through stable and long-term investments.

Research infrastructure development is progressing in stages, including the planning and promotion of national strategic projects in priority areas, the establishment of national laboratories, and the creation of interdisciplinary research centers.

Regarding human-resource development, China has secured and supported early-career, mid-career, and top-level researchers through national-level talent programs such as the "Thousand Talents Program" and the "Ten Thousand Talents Program." In recent years, support has been strengthened for projects led by young scientists, and preferential measures for researchers aged 35 and under have been introduced. These developments indicate the gradual implementation of human-resource policies aimed at generational renewal.

(3) Challenges

However, several challenges remain to be addressed. First, concerns have been raised about the uneven distribution and efficiency of funding. Owing to the strong emphasis on alignment with national strategic priorities, investment has become concentrated in particular fields, resulting in insufficient funding for other important but less visible areas of basic science. In particular, stable support is necessary for foundational theoretical disciplines, such as mathematics and theoretical physics, which are less directly linked to immediate applications.

Second, the institutional environment necessary to nurture original research is not fully developed. Formalistic KPIs and administrative procedures can restrict academic freedom and undermine researchers' creativity. There is a growing need for policies that expand the discretion of universities and research institutes to plan and conduct basic research independently, as well as initiatives that strengthen academic freedom and improve the scholarly climate.

Third, basic research is inherently long-term and difficult to conduct. It does not easily translate into short-term industrial applications or immediate practical outcomes, and it often takes many years for the results to manifest as concrete technological innovation or economic value. Consequently, its dynamics do not align well with administrative evaluation cycles, such as five-year plans. This temporal asymmetry can influence researchers' choices of topics, potentially encouraging a shift toward applied themes that promise quicker results than long-term exploratory research. In China, quantitative indicators, such as the number of SCI papers, citation counts, and patent filings continue to play major roles in research evaluations. However, the assessment of basic research requires long-term and qualitative perspectives as well as the ability to judge originality and potential impact. Policymakers tend to emphasize the "visibility" and "practicality" of results, whereas researchers engaged in basic science operate with different time horizons and evaluation criteria. This gap in expectations may contribute to a decline in researcher motivation and accelerate the outflow of talented individuals.

Furthermore, strengthening the link between basic research, applied research, and industrialization remains a major challenge. Although China emphasizes the integration of basic research, applied research, and industrialization," institutional mechanisms to bridge these phases are insufficient, and in many cases, the pathway from research results to practical application is not clearly defined. It is necessary to clarify the division of roles between the public and private sectors, improve the mechanisms of intellectual property utilization, and shift toward an open-innovation–oriented R&D system.

China's basic research policies have achieved consistent results under national strategic guidance. Nevertheless, several structural issues persist in areas such as system design, human resource development, and resource allocation. To achieve more balanced and sustainable development of basic research, China must foster a freer and more creative research environment, strengthen cross-disciplinary research support systems, and deepen regional and international collaboration.

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6 Policy for Commercialization of Scientific and Technological Achievements

This chapter introduces several policies implemented by the Chinese government to prevent research results from remaining unused and to promote the integration of research and industry. In China, this process is referred to as "achievement transformation." According to Article 2 of the Law on Promoting the Transformation of Scientific and Technological Achievements, the transformation of scientific and technological achievements refers to activities that generate new technologies, materials, and products through continuous experimentation, development, application, and dissemination of research results with practical value derived from scientific and technological R&D, fostering the development of new industries and enhancing productive capacity.

6.1 Amendment of the Law on Promoting the Transformation of Scientific and Technological Achievements (2015)

The Law on Promoting the Transformation of Scientific and Technological Achievements, originally enacted in 1996, underwent a major revision in 2015—the first substantial overhaul in nearly two decades. This amendment aimed to strengthen institutional frameworks that facilitate the transformation (commercialization) of R&D. Key provisions included expanding the discretionary authority of research institutes and universities, establishing rules for distributing profits from outcomes, and streamlining procedures for transactions involving property rights. Following this amendment, technology transfer activities at Chinese universities and research institutions became more dynamic, resulting in increased equity-based commercialization and the establishment of spin-off companies.

(1) Background

In August 2015, the 16th Session of the Standing Committee of the 12th National People's Congress approved an amendment to the Law on Promoting the Transformation of Scientific and Technological Achievements, which came into force on October 1. This revision was the first in 20 years. As China's scientific and technological system reforms deepened alongside social and economic development, the amendment aimed to simplify and correct complex and unreasonable review procedures related to the commercialization of research results while improving researchers' motivation.

Covering six chapters and fifty-two articles, the amendment focuses on three objectives: (1) resolving institutional obstacles that restrict the transformation of scientific and technological achievements, (2) redefining the relationship between government and the market to facilitate a market-oriented mechanism, and (3) placing greater emphasis on "people" by unlocking researchers' enthusiasm and potential for achievement transformation.

(2) Main Content

○ Goal: Resolving the communication gap between the supply side and demand side of science and technology achievements

○ Improvement Measures:

① Establishment of a Science and Technology Reporting System and Information System

- The government should establish a science and technology reporting system and an achievement information system to disclose the implementation status of science and technology projects, their outcomes, and intellectual property information.
- Disclosure must not result in the leakage of state or trade secrets.
- For information that cannot be disclosed, relevant departments must promptly notify the concerned parties.
- For projects funded by public finance, responsible personnel must submit science and technology reports and register achievements and intellectual property information in the system.
- Submission of reports is also encouraged for projects funded by nongovernmental sources.

② Regulatory Compliance and Corrective Measures

- When projects funded by public financial resources fail to submit the required reports according to regulations, relevant authorities may order corrective action.
- In cases of serious violations, formal warnings or project suspension may be imposed.

○ Goal: Ensuring Rewards and Compensation for Researchers

○ Improvement Measures:

① Standards for Rewards and Remuneration

- Institutions producing scientific and technological achievements are obligated to provide rewards and remuneration to contributing researchers.
- When achievements are transferred or licensed, researchers who make significant contributions must receive at least a 50% increase in income.
- When the institution implements the achievement independently, contributing researchers are guaranteed the right to continuously receive a certain proportion of operating profit.

② Obligations of State-Owned Institutions

- State-established R&D and higher education institutions must stipulate methods and amounts of rewards and remuneration, and appropriately benefit individuals contributing to the practical application of scientific and technological achievements.

○ Goal: Transferring the Right to Dispose of, Use, and Manage Scientific and Technological Achievements

○ Improvement Measures:

① Authority for Transfer, Licensing, and Equity Contribution Based on Valuation

- Nationally established R&D and higher education institutions have the authority to transfer, license, or make equity contributions based on the valuation of scientific and technological achievements. Pricing must be determined through mutual agreements, public listings, auctions, or similar mechanisms.
- Institutions must publicly disclose the name of the achievement and intended price internally.

② Use of Income

・All income generated from commercialization belongs to the institution, with rewards provided to contributing researchers.
・Remaining income should primarily support scientific and technological R&D and the practical application of achievements.

6.2 Notice on Further Delegating Authority and Promoting the Commercialization of Scientific and Technological Achievements (2019)

This notice aims to accelerate the commercialization of scientific and technological achievements by research institutions and promote technological innovation within industry. It delegates greater authority to research organizations, enhancing flexibility and autonomy in transforming research results. Specific measures include reinvesting commercialization revenues, distributing related rewards, and developing a transparent technology transaction market.

(1) Background

As domestic and international technological competition intensified, the commercialization and practical application of scientific and technological achievements remained slow. To address the insufficient authority and flexibility of research institutions, the Ministry of Finance issued the "Notice on Further Delegating Authority and Promoting the Transfer and Transformation of Scientific and Technological Achievements" in September 2019, advancing the "delegation-regulation-service" reform.

(2) Main Content

1) Delegating Authority and Streamlining Procedures

・National universities and R&D institutions may independently decide on the transfer, licensing, and investment of scientific and technological achievements, provided national security or classified information is not involved. Special review and approval procedures are unnecessary.
・Even when the national secrecy system is involved, procedures are streamlined.
・Transfers of state-owned equity, gratuitous transfers, and the introduction of foreign capital may be autonomously managed without Ministry of Finance approval or reporting.

2) Optimization of Evaluation and Management, and Clarification of Revenue Attribution

・Research institutions may independently decide whether to conduct asset appraisals when transferring or investing in scientific and technological achievements. Prices are determined by mutual agreement, and the achievement name and proposed price must be disclosed.
・Revenue obtained from the achievement transformation is incorporated into the institution's budget, not remitted to the state treasury, and is primarily used for research activities and staff rewards.

3) Ensuring Institutional Responsibility and Strengthening Oversight

・Research institutes and higher education institutions must comply with laws on commercialization, standardize transformation procedures, and establish a leadership group system for collective decision-making.

- Misconduct or collusion occurs during commercialization results in penalties per relevant regulations. Management of state-owned assets is strengthened with internal controls and risk management.
- Oversight responsibilities are reinforced, with strict supervision of commercialization activities.

4) Encouraging Local Innovation and Reform

- Local financial authorities support the transformation of scientific and technological achievements and establish management systems aligned with regional economic and industrial restructuring.
- Local governments should implement concrete regulations to promote achievement transformation and support regional development.

6.3 Commercialization of Scientific and Technological Achievements in "The Decision on Further Deepening Reform across the Board and Advancing Chinese-Style Modernization" (2024)

The Decision on Further Deepening Reform across the Board and Advancing Chinese-Style Modernization also addresses the transformation of scientific and technological achievements. It emphasizes accelerating the transformation of research results, strengthening related incentives, and promoting market-driven mechanisms to utilize scientific and technological achievements more effectively in society and the economy, and supporting industrial development. This series of reforms concerning the transformation of research results is intended to accelerate the social implementation of science and technology and strengthen the competitiveness of enterprises and industries. Throughout this process, technology transfer and market-oriented approaches play central roles.

(1) Background

The Decision on Further Deepening Reform across the Board and Advancing Chinese-Style Modernization, released in July 2024, is one of the most important policies for realizing socialist modernization by 2035. It focuses on accelerating the commercialization and practical application of scientific and technological achievements, as well as strengthening collaboration with industry. With respect to the transformation of scientific and technological achievements, the policy aims to utilize research results more effectively in society and the economy, supporting industrial development. This calls for greater delegation of authority and stronger incentives for research institutes and enterprises, along with a market-oriented approach. Enhancing regional economies and international competitiveness has also been identified as a key priority.

(2) Main Content

1) Acceleration of Achievement Commercialization

This decision calls for research institutions and enterprises to accelerate the process of transferring scientific and technological achievements to industry to promote their practical application. In particular, authority related to achievement commercialization is being delegated, and institutional autonomy is strengthened for state-owned enterprises, higher education institutions, and R&D organizations.

Simultaneously, legal frameworks and policy measures are being reinforced to improve commercialization efficiency.

2) Promotion of Innovation

This decision emphasizes the commercialization of scientific and technological achievements as a means of enhancing corporate competitiveness. It calls for the promotion of industrial technological innovation and the development of emerging industries that contribute to high-quality economic growth. It also seeks to strengthen the innovation capabilities of enterprises and deepen industry–university–research collaboration led by the corporate sector.

3) Incentives for Achievement Commercialization

The policy strengthens the rewards and incentives for researchers and engineers involved in the commercialization of scientific and technological achievements, encouraging active participation in such activities. Clear evaluation systems and compensation schemes should be established for individuals and teams that contribute to commercialization, with the aim of enhancing the motivation of researchers and engineers.

4) Market-Driven Achievement Commercialization

A market-driven approach is emphasized for the commercialization of scientific and technological achievements. When using government support, it is necessary to fully leverage the capabilities of private enterprises and market forces to promote technology transfer and commercialization. Efforts are underway to develop technology markets and improve the investment environment that supports commercialization, and active participation by private enterprises is being encouraged.

5) Strengthening Cooperation Between Local Governments and Industry

Local governments are expected to formulate support measures for commercialization that align with regional economic needs and contribute to local economic development. Additionally, stronger industry–academia collaboration between local universities, R&D institutions, and enterprises is emphasized to establish cooperative frameworks that facilitate the commercialization of achievements tailored to region-specific challenges and demands.

6) Internationalization and Strengthening of Global Competitiveness

To enhance international competitiveness, an international perspective is emphasized in the commercialization of scientific and technological achievements. Policy measures are being considered to promote technical cooperation with foreign enterprises and transfer technologies to international markets.

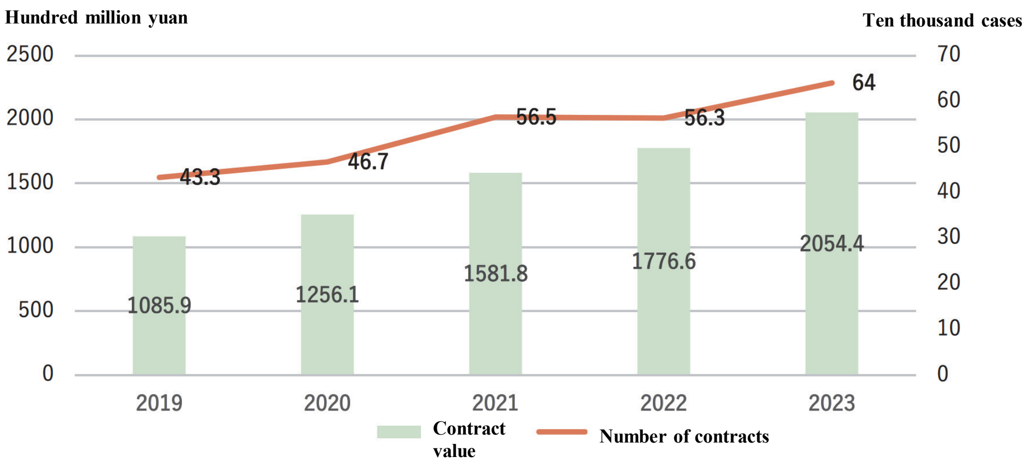
6.4 Status of the Transformation of Scientific and Technological Achievements at Universities and Research Institutes

In China, under the leadership of the Ministry of Science and Technology (MOST) and the Ministry of Finance, the China Association for Science and Technology Evaluation and Achievement Management, the Science and Technology Evaluation Center of MOST, and the Institute of Scientific and Technical Information of China jointly published the Annual Report on the Transformation of Scientific and Technological Achievements (Higher Education Institutions and Research Institutes) since 2018. According to the 2023 edition of the report, the total value of technology transfer contracts related to scientific and technological achievements at universities and research institutes has shown a steady upward trend, increasing from 108.59 billion yuan in 2019 to 205.44 billion yuan in 2023. Annual revenue from achievement transfers also rose from 81.17 billion yuan in 2020 to 135.27 billion yuan in 2023. The number of transformation projects conducted by universities and research institutes has increased, and the total number of technology transfer contracts rose from 433,000 in 2019 to 640,000 in 2023.

The establishment of specialized technology-transfer institutions within universities and research institutes, along with the development of professional technology-transfer teams, constitutes a critical component in further reforming and improving the system for transforming scientific and technological achievements in universities. By the end of 2023, 1,038 universities and institutes had established dedicated technology-transfer organizations, and 17,881 university and institutional personnel were engaged in the transfer and commercialization of scientific and technological achievements. Institutional and human resource frameworks supporting technology transfer and commercialization continue to expand.

Cooperation among universities, research institutes, and enterprises is an important means of contributing to national strategies and regional economic development. By the end of 2023, the number of R&D institutions, technology-transfer organizations, and commercialization service platforms jointly established by universities, research institutes, and enterprises had reached 19,574. These institutions and platforms absorb and integrate resources from multiple sectors, continuously support the transfer and commercialization of scientific and technological achievements, and play a key role in connecting the supply and demand of these achievements.

From the perspective of conversion pathways, the science and technology achievements transferred by universities and research institutes through relocation, licensing, and investment are concentrated in the fields of manufacturing, scientific research, technical services, agriculture, forestry, animal husbandry, and fisheries. By 2023, these three sectors will account for 73.7% of the total contract value. From the perspective of conversion regions, approximately 60% of scientific and technological achievements are converted locally through transfers, licensing, or investments, playing an active role in promoting local economic and social development.



Source: Annual Report on the Transformation of China's Scientific and Technological Achievements 2023

Figure 6-1 Number and total value of technology transfer contracts in higher education institutions and research institutes

【References for Chapter 6】

1. The original policy documents can be accessed on the website of the Chinese Government and the official website of the Ministry of Science and Technology.
2. ScienceNet: "Annual Reports on China's Science and Technology Achievement Transformation 2023 and 2024 Released" (September 2024).
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7 Industrial Policy

7.1 Evolution of Industrial Policy

This chapter provides an overview of the key industrial policies implemented under the Xi Jinping administration. Before proceeding, a brief overview of China's industrial policy since the founding of the nation is presented. Since the reform and opening-up, China's industrial policy has evolved in stages alongside the transition from a planned economy to a market-oriented economy. The approach has shifted from state-led strategic development to alignment with market mechanisms, and more recently to a technology-driven, innovation-focused model.

(1) From the Planned Economy Era to the Early Reform and Opening-Up Era (1978–Early 1990s)

Following the 1978 reform and opening-up, the Chinese government's industrial modernization strategy focused on developing the industrial base and attracting foreign investment. This was primarily achieved by improving the efficiency of state-owned enterprises and promoting openness to the outside world. Early industrial policy concentrated support on heavy and capital-intensive industries through Five-Year Plans, while promoting light industry for export via Special Economic Zones and coastal open cities. In the 1980s, "industrial structure adjustment policies" were adopted to shift the economy from labor-intensive to capital- and technology-intensive industries.

(2) Market Economy Reform and Expanded Foreign Investment Utilization (Mid-1990s to Early 2000s)

Following Deng Xiaoping's 1992 "South Tour Speeches," the establishment of a socialist market economy system was clearly articulated, and industrial policy correspondingly became more flexible and market-oriented. Policies during this period aimed to foster high-tech industries, upgrade industrial technology, reform state-owned enterprises, encourage private enterprise, and open sectors in preparation for WTO accession (2001). These initiatives were led by the National Development Planning Commission (now the National Development and Reform Commission). To attract foreign investment, a range of tax incentives was introduced for foreign-invested enterprises, including joint ventures and cooperative enterprises. These incentives positively affected sectors such as electronics, telecommunications, and automobiles. Industrial policy during this period followed a three-pronged approach: "introducing foreign investment, opening up markets, and acquiring technology."

(3) Transition to a National Strategic Industrial Policy (2006–2010s)

Following the 2006 "National Medium- and Long-Term Program for Science and Technology Development (2006–2020)," China fully transitioned to a technology-driven industrial policy centered on "Independent Innovation." A defining feature of this period was the adoption of the "Strategic Emerging Industries (SEI)" policy. In 2010, seven sectors were designated as SEIs: new energy, automobiles, next-generation information technology, biotechnology, high-end equipment manufacturing, new materials, and environmental protection. Comprehensive support measures, including fiscal assistance, tax incentives, and R&D subsidies, were implemented. Furthermore, the 2015 "Made in China 2025" initiative, modeled after Germany's Industry 4.0, was launched as a national strategy to promote smart manufacturing, digitalization, and the advanced equipment industry.

(4) Strengthening Self-Reliance Amid U.S.–China Rivalry (2018–Present)

Since 2018, industrial policy has placed greater emphasis on "self-reliance" in response to intensifying U.S.–China trade and technology frictions. The focus has been on reducing foreign dependence and developing a domestic technology ecosystem. In particular, state-led R&D funding has increased significantly, accompanied by strong support for domestic production in core technology sectors such as semiconductors, AI, aerospace, quantum communications, and biotechnology. Furthermore, the 14th Five-Year Plan (2021) introduced a new development pattern centered on "domestic circulation as the mainstay, promoting dual circulation between domestic and international markets," making supply chain stability and the strengthening of the domestic market strategic priorities.

From 2023 onward, the focus has shifted to cultivating future technologies and securing global competitiveness, with special emphasis on the "Eight Emerging Industries" and "Nine Future Industries" as part of a national strategy. The "Eight Emerging Industries" include biomedicine, new energy, new materials, advanced manufacturing, the digital economy, green technologies, the space industry, and smart agriculture, with the development of industrial clusters and demonstration bases underway. The "Nine Major Future Industries" include the metaverse, generative AI, quantum information, humanoid robots, brain–machine interfaces, future displays, biomanufacturing, 6G-based future internet, and new energy storage, all designated as national-level priority research and development projects.

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7.2 Made in China 2025

This is a national strategy announced in 2015 to advance manufacturing and achieve technological independence, aiming to make China a manufacturing superpower by 2049. Its implementation has shifted the focus of China's manufacturing industry from quantity to quality, yielding measurable results. The five major policies of "Made in China 2025" are: (1) Innovation-Driven, (2) Quality First, (3) Green Development, (4) Structural Optimization, and (5) People-Oriented. The ten key high-tech fields prioritized are: (1) Next-Generation Information and Communication Technology, (2) Advanced Digital Control Machine Tools and Robots, (3) Aerospace Equipment, (4) Marine Construction Machinery and High-Tech Ships, (5) Advanced Rail Transit Equipment, (6) Energy-Saving and New Energy Vehicles, (7) Power Equipment, (8) Agricultural Machinery and Equipment, (9) New Materials, and (10) Biopharmaceuticals and High-Performance Medical Equipment.

Among the industrial policies launched under the Xi Jinping administration, "Made in China 2025" is arguably the most significant. Launched by the State Council in 2015, the plan defined manufacturing as the foundation of China's economy, the cornerstone of national existence, a tool for national rejuvenation, and the basis for becoming a strong nation. However, compared with the world's most advanced nations, China's manufacturing sector is still "large in scale" but not yet "strong." It lags in independent innovation, resource efficiency, industrial structure, informatization, quality, and production efficiency. Many analysts argue that a transformation in production methods is urgently needed.

(1) Goal

The strategic goal of becoming a manufacturing superpower is structured around a three-step approach:

Step 1: Join the ranks of global manufacturing powers by 2025.

By 2020, China aimed to complete industrialization, consolidate its position as a major manufacturing nation, and enhance the informatization of manufacturing. It sought to master key core technologies in priority fields, strengthen competitiveness in strategic areas, and improve quality. The plan also aimed to achieve digitalization, networking, and intelligent transformation in manufacturing, while significantly reducing energy and raw material consumption, as well as pollutant emissions, per unit of industrial added value in key industries.

By 2025, the goal is to elevate overall manufacturing capabilities, enhance innovation, increase labor productivity, and advance the integration of industrialization and informatization. Energy consumption, raw material use, and emissions per unit of industrial added value in key sectors are expected to reach world-leading levels. Multiple globally competitive enterprises and industrial clusters are to emerge, strengthening China's position in the global division of labor and value chains.

Step 2: By 2035, elevate China's manufacturing sector to the mid-tier level among global manufacturing powers.

This includes strengthening innovation, achieving breakthroughs in key areas, enhancing overall competitiveness, building industries capable of leading global innovation, and achieving full industrialization.

Step 3: By 2049, the centenary of the People's Republic of China, consolidate the position as a major manufacturing nation and enter the leading group of global manufacturing powers.

The goal is to lead innovation, develop distinct competitive advantages in key manufacturing sectors, and build a world-class technological and industrial system.

(2) Key Areas and Key Strategies

The Made in China 2025 initiative emphasizes high-quality production, environmentally conscious manufacturing processes, and the integration of the Internet of Things (IoT) as core strategies. Digitalization is a central measure to implement these strategies. The table below illustrates the key industries and strategies identified under the plan.

○ Industries designated as key sectors in "Made in China 2025":

Key Industries	Key Fields
Next-Generation Information and Communication Technologies	Integrated circuits/specialized equipment, 5G, operating systems and industrial software, etc.
High-Level Numerical Control Machine Tools and Robots	High-level machine tools, robots for various industrial fields
Aerospace Equipment	Large aircraft, passenger aircraft engines, high-performance composite materials, etc.
Marine Engineering Equipment and High-Tech Vessels	Marine resource exploration and development vessels, deep-sea facilities, etc.
Advanced Rail Transportation Equipment	Utilization of new materials and technologies, high-speed rail, advancement of rail transportation equipment, etc.
Energy-Saving and New Energy Vehicles	Electric vehicles, fuel cell vehicles, next-generation vehicle components, etc.
Power Generation Equipment	High-efficiency coal-fired power generation equipment, hydroelectric power generation, nuclear power generation, smart grids, etc.
Agricultural Machinery	Advanced agricultural machinery equipment, smartification of various machinery, etc.
New Materials	Special metal functional materials, high-performance structural materials, high-performance polymer materials, nanotechnology-related materials, etc.
Biomedical and High-Performance Medical Devices	New vaccines, traditional Chinese medicine, DNA analysis technology, high-performance medical devices, etc.

○ Nine Key Strategies of "Made in China 2025"

Key Strategies	Main Content
Enhancing National Manufacturing Innovation Capabilities	Establish "Manufacturing Innovation Centers" to support development in the 10 fields listed in the table above. Plans to establish 15 innovation centers by 2020; the "National Power Battery Innovation Center" and the "National Additive Manufacturing and New Materials Innovation Center" have already been established.
Integration of Informatization and Industrialization	Promote investment in manufacturing equipment and product development leveraging IoT technologies. Strengthen internet infrastructure to support digitalized manufacturing.
Strengthening Industrial Foundational Capabilities	Strengthen the foundations of core components, basic processes, fundamental materials, and industrial technologies to enhance product quality and innovation capabilities. Focus not only on applied research but also on fundamental research.
Strengthening Quality and Brand Power	Aim to raise the level of basic capabilities to improve quality in the manufacturing industry.
Comprehensive Promotion of Green Manufacturing	By 2020, build 1,000 model green manufacturing factories and 100 green parks.
Rapid Development in Key Areas	Key areas refer to the 10 areas listed in the table above.
Structural Control of Manufacturing	Promote cooperation between large and small and medium-sized enterprises and resolve issues such as excess production capacity.

Promoting the Development of Service-Oriented Manufacturing and Producer-Oriented Service Industries	Develop producer services related to manufacturing, including e-commerce, consulting, intellectual property, and after-sales support.
Improving the Level of Internationalization of Manufacturing	Promote technical cooperation with overseas companies, focusing on the 10 fields listed in the table above. Support Chinese companies' overseas expansion.

(3) Achievements

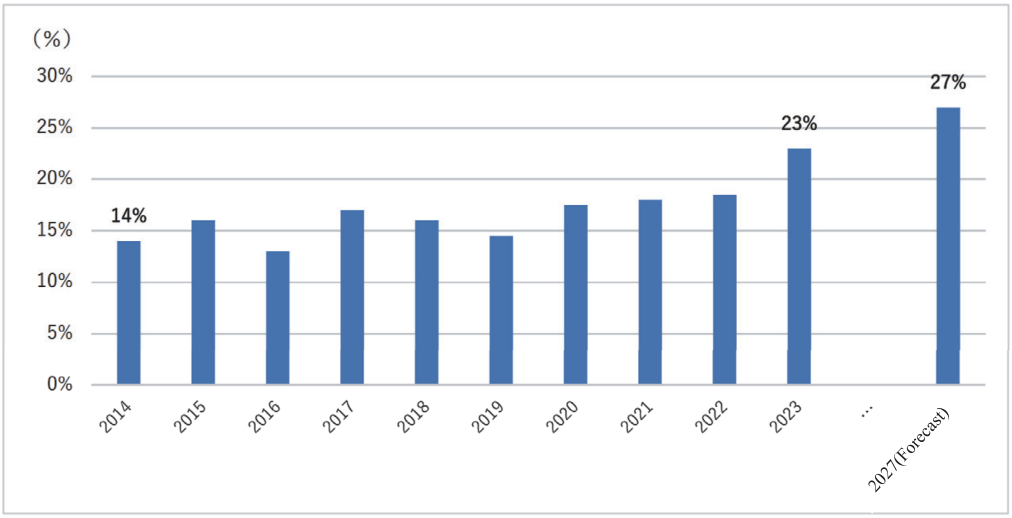
Through the implementation of "Made in China 2025," China's manufacturing sector has shifted from a focus on quantity to quality, achieving notable results:

- **Advancement in manufacturing sophistication and technological innovation**: Research and development has intensified in cutting-edge fields such as AI, robotics, semiconductors, aerospace, and medical equipment, with significant progress in promoting smart manufacturing and accelerating digitalization.
- **Industrial restructuring and value enhancement**: The economy has shifted from traditional low-cost, labor-intensive industries to sectors based on high-performance products and innovative technologies, strengthening competitiveness in domestic and international markets. Key achievements are evident in electric vehicles, new energy sectors, and high-performance materials.
- **Domestic production of key technologies**: Efforts to manufacture high-precision industrial machinery, semiconductors, industrial software, and other technologies previously dependent on foreign sources are advancing, improving technological self-reliance.
- **Policy support framework**: The government has bolstered manufacturing competitiveness through subsidies, tax incentives, and R&D funding. At the same time, protecting and nurturing the domestic market has fostered the growth of domestic enterprises.
- **Enhanced international competitiveness**: Many Chinese companies have expanded into global markets through acquisitions of foreign firms and technological partnerships. Chinese products are becoming increasingly prominent, particularly in smartphones, electric vehicles, and renewable energy.

(4) Semiconductor Industry

Regarding the semiconductor industry, the "Made in China 2025" initiative set targets to increase the self-sufficiency rate for essential core components to 40% by 2020 and 70% by 2025. However, these targets were not achieved due to U.S.–China trade frictions, U.S. restrictions, the high-profile Huawei and ZTE cases, and insufficient domestic capabilities in semiconductor technology development and mass production.

Despite substantial subsidies and tax incentives, Nikkei Asia reports that China's semiconductor self-sufficiency rate was only 23% in 2023. Although this represents an increase from 14% in 2014 and is projected to reach 27% by 2027, it falls far short of the Made in China 2025 targets. The self-sufficiency rate for domestic companies alone—excluding foreign-funded enterprises—was even lower, at just 6.6% in 2021, remaining below 10%.



Source: Nikkei Asia, "China rushes to boost domestic chip supply ahead of Tump's return"

Figure 7-1 China's Semiconductor Self-Sufficiency Rate

Taiwan and the United States dominate global manufacturing of high-performance logic semiconductors, while China has yet to achieve significant breakthroughs in advanced process technologies. As of 2021, Chinese semiconductor sales accounted for only 7% of global industry revenues. Semiconductors produced in China still have relatively large circuit widths, lagging behind the most advanced technologies. China's presence in the design market remains limited, and progress in semiconductor design continues to rely on external sources. Chinese semiconductor companies face multiple challenges, including a shortage of skilled talent, limited effectiveness of industrial policies, and relatively high manufacturing costs.

7.3 Emerging Technologies and Future Industry Policy

In the face of intensifying international competition in emerging technologies, fostering and developing these technologies remains a critical challenge for China. Domestically, the "Eight Major Emerging Technology Industries" and the "Nine Major Future Industries" are increasingly viewed as "new quality productive forces" driving economic growth and scientific advancement. The "Eight Major Emerging Technology Industries" are: (1) Next-Generation Information Technology, (2) Biotechnology, (3) New Energy, (4) New Materials, (5) High-End Equipment Manufacturing, (6) New Energy Vehicles, (7) Green Environmental Protection, and (8) Aerospace and Marine Equipment Industries. The "Nine Major Future Industries" are: (1) Metaverse, (2) Brain–Machine Interface, (3) Quantum Information, (4) Humanoid Robots, (5) Generative AI, (6) Bio-manufacturing, (7) Future Displays, (8) 6G-Based Future Internet, and (9) New Energy Storage.

(1) Background

China has designated the development of a "science and technology superpower" as a national strategy. This initiative aims to improve the quality of the Chinese economy and strengthen its international competitiveness. The focus is on two key areas: cultivating emerging technologies and developing future industries. The 14th Five-Year Plan (2021–2025) and the Outline of Long-Term Objectives Through

2035 explicitly emphasize "advancing strategic emerging industries" and "proactively fostering future industries," driving a technology-led structural transformation. Within this framework, the cultivation of the "Eight Major Emerging Technology Industries" and the "Nine Major Future Industries" has been formally positioned as a national strategy. Policy documents from the 14th Five-Year Plan onward provide targeted support and outline institutional development for these sectors.

(2) Eight Major Emerging Technology Industries

Since 2023, the Chinese government has identified the following eight industries as policy priorities, promoting their industrialization and advancement:

- Next-Generation Information Technology: AI, cloud computing, big data, 5G, quantum communication, etc.
- Biotechnology: Biopharmaceuticals, gene editing, regenerative medicine, etc.
- High-End Manufacturing Equipment: Smart manufacturing, CNC equipment, industrial robots, etc.
- New Materials: Advanced composite materials, semiconductor materials, graphene, etc.
- New Energy: Solar power, hydrogen energy, smart grids, etc.
- New Energy Vehicles: NEVs, autonomous driving, etc.
- Green Environmental Protection Industry: Circular economy, decarbonization technology, etc.
- Aerospace and Marine Equipment Industry: Satellite development, deep-sea exploration, etc.

These sectors are being strategically nurtured through the development of national-level high-tech zones and industrial clusters. Growth is being pursued through the integration of advanced manufacturing and the digital economy.

(3) Nine Major Future Industries

According to the "Future Industry Development Report" released at the end of 2024, the following nine areas have been explicitly identified as "future industries" that will form the foundation of the next-generation economy and society:

- **Metaverse**: Integrates virtual reality (VR), augmented reality (AR), digital twins, blockchain, etc., with applications anticipated in industry, education, healthcare, and administration.
- **Brain–Machine Interface (BMI)**: Enables direct brain–computer connectivity for thought transmission and control. Applications range from medical use to military applications.
- **Quantum Information**: Encompasses quantum communication, quantum computing, and quantum sensing. China maintains technological leadership through its quantum communication satellite "Mozi."
- **Humanoid Robots**: Human-like robots designed for caregiving, manufacturing, and service sectors.
- **Generative AI**: Utilizes natural language processing, image generation, and conversational AI to support creative industries and research.
- **Bio-manufacturing**: Next-generation industrial forms producing chemicals, energy, and food through bio-processes based on synthetic biology.
- **Future Displays**: Advanced display technologies, including foldable screens, OLED, micro-LED, and holographic projection.

- **Future Internet based on 6G**: Next-generation communication infrastructure featuring high reliability, low latency, and ultra-high capacity. Technology development is underway, targeting commercialization by 2030.
- **Next-Generation Energy Storage**: Technologies such as large-capacity batteries, compressed air, and flywheels, which are essential for stable renewable energy supply.

In these nine fields, central and local governments are collaborating to advance R&D support, establish standards, construct demonstration bases, and develop a risk investment environment. Fiscal investment is being strengthened, particularly through the "Future Industry Fund" and national key R&D programs.

The "Eight Major Emerging Technology Industries" and the "Nine Major Future Industries" have the potential to transform China's industrial structure and are central to its strategy to "take the initiative" in global technological competition.

(4) Promotion Framework

To foster these industries, China has introduced a mechanism that integrates top-down government policy with bottom-up initiatives from companies and the market. Key systems include:

- **Reform of the science and technology project system**: Expanding project selection through "challenge-driven open calls" and shifting to results-oriented funding allocation.
- **R&D incentives**: Expanding researchers' rights to profit sharing from inventions made in the course of their duties and establishing flexible licensing systems for research outcomes.
- **Industrial finance development**: Strengthening venture capital, science and technology insurance, and government-led investment funds (guide funds) to facilitate the commercialization of research outcomes.
- **Establishment of national-level hubs**: Promoting ecosystem formation through regional hubs such as "Future Industry Pilot Zones" and "Technology Innovation Centers."

International deployment of Chinese-origin technology standards and innovation achievements is also a priority. In fields such as 6G, quantum communication, and smart manufacturing, Chinese companies and research institutions are increasing their influence within international standardization bodies. While decoupling trends are advancing globally, China continues to promote joint research and market development with Asian and emerging countries, attempting to export the "Chinese model." The "Eight Major Emerging Industries" will form the core of technological and industrial competition over the next 5–10 years, while the "Nine Major Future Industries" represent foundational R&D areas with a 10–20 year horizon. Through these initiatives, the Chinese government aims to transition to an innovation-driven growth model and secure a leading position in global technological leadership.

7.4 Sector-Specific Industrial Policy

7.4.1. AI Industry

The evolution of China's AI industry development policies can be divided into the following three phases.

Phase 1: Introduction Phase **Key Policies: Made in China 2025 (2015)** **13th Five-Year Plan (2016)** **Next-Generation AI Development Plan (2017)**	**Phase 2: Expansion Phase** **Key Policy: 14th Five-Year Plan (2021)**	**Phase 3: Integration Phase** **Key Policy: AI + (2024)**
・AI designated as a national key mission for the first time ・Next-generation AI development strategic goals established ・AI regulations and ethical guidelines introduced ・AI industry designated as a national strategic industry	・Promote the development of core AI technologies ・Support the introduction and application of AI scenarios across diverse industries ・Publish regulations and oversight measures for the ethical use of AI	・Encourage the use of generative AI across diverse industrial sectors ・Increase the number of startups like DeepSeek ・Create algorithms and standards for industrial development Emphasize socialist innovative values

China's AI policy has evolved incrementally as a national strategy, positioned as a key focus area amid advancing economic and social development.

Initially, under "Made in China 2025," AI was explicitly incorporated into national policy for the first time as one of the core technologies supporting smart manufacturing. At this stage, AI was primarily viewed as a tool to enhance efficiency and automation in manufacturing. Subsequently, the 13th Five-Year Plan emphasized advanced technologies, including AI, as drivers of national development, highlighting a shift toward innovation-led growth. Within this framework, AI was recognized as a foundational technology for the new industrial revolution, alongside robotics, big data, and cloud computing. AI policy became a fully independent national strategy with the 2017 "Next Generation AI Development Plan." This plan set the clear goal of making China a global leader in AI technology by 2030. It outlined comprehensive policies, including strengthening fundamental research, systematically developing the AI industry, and establishing systems for ethics and safety. Funding for AI research and applications surged at both central and local levels. The 14th Five-Year Plan continued to position AI as a core component of strategic emerging industries, emphasizing its role as a pillar of the digital economy. The "AI +" policy, announced in 2024, established a framework to further promote cross-industry AI applications. Here, AI is framed not merely as a tool for technological innovation, but as a mechanism to optimize national governance, public services, and social management, with the deployment of practical application models being actively advanced.

The following sections detail the "Next Generation AI Development Plan" and the "AI +" policy.

(1) Next-Generation AI Development Plan (2017)

1) Background

The State Council issued the "Next-Generation AI Development Plan" in 2017 to seize strategic opportunities in AI, establish China's first-mover advantage, and accelerate the building of an innovation-driven nation and a global science and technology superpower.

This plan marked the first time AI was designated as a key national policy priority. It recognized AI as a core technology for creating new industries and driving industrial development, with applications extending beyond manufacturing to sectors such as education, healthcare, and transportation.

Compared to previous AI policies, this plan set forth more concrete and proactive objectives.

2) Strategic Goals

Stage	Strategic Objectives	Numerical Targets
Phase 1	By 2020, achieve advanced-nation levels in all AI-related technologies and applications. Cultivate the AI industry to become a new pillar of economic growth. Open new avenues for improving people's livelihoods through AI technology applications.	Achieve a scale of over 150 billion CNY (approx. 2.5 trillion JPY) for core industries and over 1 trillion CNY (approx. 17 trillion JPY) for AI-related industries.
Phase 2	By 2025, achieve breakthroughs in fundamental AI theory and technology. Aim to lead the world in certain technologies and applications. Enable AI to become a driving force for industrial development and economic growth, contributing to the construction of an intelligent society.	Realize a scale of over 400 billion CNY (approx. 6.8 trillion JPY) for core industries and over 5 trillion CNY (approx. 85 trillion JPY) for related industries.
Phase 3	By 2030, achieve world-leading levels in AI theory, technology, and application. China will become the global hub for AI innovation.	The core industry will achieve a scale of 1 trillion CNY (approx. 17 trillion JPY), with related industries reaching over 10 trillion CNY (approx. 170 trillion JPY). By the final target year of 2030, the combined economic impact of AI on the core and related industries will exceed 11 trillion CNY (approx. 187 trillion JPY).

3) Four Key Missions

To achieve the strategic goals by 2020, four key missions are presented.

Key Tasks		Main Content
1	Mass Production and Quality Improvement of Smart Products	Smart products refer to network-connected smart vehicles, smart service robots, smart unmanned aerial vehicles, medical imaging diagnostic systems, video/image-based identity verification systems, smart voice communication systems, smart translation systems, smart home appliances, etc.
2	Breakthroughs in Foundational Fields	Specifically, breakthroughs will be pursued in smart sensors, neural network chips, and open-source and open-platform fields that strengthen the development foundation for the AI industry.
3	Deepening the Development of Smart Manufacturing	Developing core technologies and equipment for smart logistics- and warehouse-related facilities, and introducing new methods for remote operation and maintenance, such as monitoring and early alerts for smart equipment.
4	Building Support Systems	Establishing a vocational training database, platforms for standard-based measurement and testing and intellectual property, smart network-related infrastructure, and network security systems.

(2) AI + Policy (2024)

1) Background

China's "AI +" policy forms part of a national strategy to promote cross-sectoral integration of AI technology into various industries and drive digital transformation across society. The policy was first introduced in the Government Work Report submitted to the Second Session of the 14th National People's Congress on March 5, 2024. In this context, the "AI + Initiative" was highlighted, emphasizing the pivotal role of deepening AI integration in fostering economic growth and strengthening industrial competitiveness.

Premier Li Qiang outlined the first of ten major government tasks for 2024, stating, "We will implement the AI + initiative. We will proactively encourage the digital transformation of manufacturing and the development, opening, circulation, and utilization of data" He added, "We will deepen research, development, and application in big data, artificial intelligence, and other areas, and build digitally competitive industry clusters with global reach."

2) Features

First, "AI +" is a top-down national strategy, advanced through collaboration among local governments, enterprises, and research institutions, with the State Council, Ministry of Science and Technology, and Ministry of Industry and Information Technology at the core. Efforts include establishing technological and institutional frameworks through initiatives such as the National AI Standardization Strategy, AI Ethics Guidelines, and support for AI chip development.

Second, in AI applications, generative AI has gained significant attention. Since 2023, major Chinese IT companies—including Baidu, Alibaba, Tencent, and iFLYTEC—have accelerated the development of large language models and integrated them into various SaaS (Software as a Service) offerings across sectors such as search, education, healthcare, and legal services. These models are deployed in domain-specific initiatives such as "AI + Education," "AI + Healthcare," and "AI + Government Services."

Third, as AI integration with the real economy advances, "AI + Manufacturing (Smart Manufacturing)" has emerged as a leading sector. AI technologies are being used for process optimization, defect rate prediction, and the introduction of autonomous control systems, particularly for emerging manufacturers and SMEs. The initiative aims to enhance productivity and reduce costs.

AI + represents more than a policy initiative; it signals a new era of widespread AI implementation. Since the 2015 Government Work Report introduced the "Internet +" initiative, industries have increasingly integrated internet technology, driving new levels of industrial development. Similarly, AI + is expected to link AI technology to all industries and application scenarios, fostering the creation of new industries and innovation pathways.

7.4.2. Robotics Industry

The Chinese government has launched initiatives such as "Made in China 2025" and the "Robotics Industry Development Plan for the 14th Five-Year Plan Period," aiming to establish China as a global robotics superpower. Efforts focus on expanding applications across a wide range of fields, particularly industrial and service robots, while prioritizing domestic production of servo motors, reducers, and controllers, and integrating robotics with AI and 5G technologies. In addition to promoting industrial development and technological innovation, China is establishing safety standards for the robotics industry and strengthening legal regulations. By supporting domestic companies, it seeks to leverage the "Digital Silk Road" and "Belt and Road" initiatives to expand into overseas markets. However, stagnation in domestic semiconductor and motor production, caused by U.S. sanctions, is limiting the development of high-performance robots.

The robotics industry is included among the ten key industries of "Made in China 2025." The initiative sets goals for developing industrial and service robots to enhance productivity and reduce costs, using robotics to advance automation and smart manufacturing. It also emphasizes reducing foreign dependency by promoting domestic robot production and expanding domestic market share.

(1) China's Robotics Industry Development Plan for the 14th Five-Year Plan Period (2021–2025)

1) Background

In December 2021, the Chinese government released the "Robotics Industry Development Plan for the 14th Five-Year Plan Period (2021–2025)" to accelerate high-quality development in the robotics sector. The plan describes robots as "the jewel at the pinnacle of manufacturing," asserting that research, development, manufacturing, and application of robots are key indicators of a nation's scientific innovation and high-end manufacturing capabilities. Robots are also transforming production and lifestyles, acting as a powerful driver of economic and social development.

This plan serves as a strategic roadmap to accelerate technological innovation and market expansion in the robotics industry, guiding China toward becoming a global robotics superpower.

2) Goals by 2025

- Become a global leader in the robotics industry.
- Significantly expand the industry scale, maintaining an annual growth rate of over 20%.
- Increase the market share of domestically produced robots from approximately 30% in 2020 to over 50% by 2025.
- Align with international robotics standards to enhance global competitiveness.

3) Key Strategies

Strategy	Content
Accelerating Technological Innovation	Promote domestic production of the "three core components" of robots (servo motors, reducers, controllers).
Advancement of Industrial Robots	Develop precision manufacturing and smart control technologies.
Expansion of Service Robots	Promote adoption across diverse fields, including healthcare, logistics, and education.
Integration of Robotics with AI and 5G	Promote the widespread adoption of smart robots.
Strengthening Policy Support	Support companies through tax incentives, subsidies, and special zone policies.

4) Key Technologies and Industrial Clusters

Category	Item	Key Contents
Key Industries	Core robotics technology development	Advanced sensor technology development (evolution of vision, tactile, and force sensors)
		Development of autonomous learning robots through AI integration
		High-precision robot control technology (improving flexibility and precision machining)
	Development of next-generation industrial robots	Expanded applications in automotive, electronics, metal processing, chemical, food, and pharmaceutical manufacturing
		Promotion of collaborative robot development (human–robot cooperative work)
		Advancement of "smart manufacturing" in factories
	Development of service robots	Medical robots (surgical assistance robots, care robots, rehabilitation robots)
		Logistics and delivery robots (unmanned warehouses, unmanned delivery, drone logistics)
		Home robots (cleaning, care, education, pet robots)
Industrial Clusters	Establishment of robot industry bases	Formation of robot industry clusters centered on Beijing, Shanghai, Guangdong, Jiangsu, and Zhejiang
		Strengthening robot technology R&D bases in major cities
	Enhanced support for SMEs	Support for robotics-related start-ups
		Promotion of robot adoption by SMEs (spread of smart manufacturing)

(2) Implementation Plan for the "Robotics +" Application Initiative (2023)

1) Background

In January 2023, the Ministry of Industry and Information Technology announced the implementation plan for the "Robotics +" application initiative to support key industries outlined in the "Robotics Industry Development Plan for the 14th Five-Year Plan Period." Building on "Made in China 2025" and the 14th Five-Year Plan robotics strategy, this initiative aims to integrate robotics technology across a wider range of industries and into various aspects of social life.

2) Basic Policy and Goals through 2025

Goals by 2025	Significantly expand the adoption of robots in key industries to promote economic growth. Advance robot standardization to enhance safety, compatibility, and efficiency. Accelerate robot-related technological innovation and develop smart robots integrated with AI, 5G, and IoT. Implement over 100 demonstration projects to expand robot utilization across industries.
Basic Policy	Integrate robotics technology and industry (expanding applications to manufacturing, agriculture, logistics, healthcare, education, etc.). Develop and introduce new technologies (integration with AI, 5G, and IoT). Strengthen policy support (subsidies, tax incentives, establishment of technical standards). Promote the integration of robots into social life (popularization of service robots).

3) 10 Key Priority Areas

The promotion of robot adoption is explicitly stated in the following 10 priority areas.

Field	Main Content
Manufacturing	Factory automation, smart manufacturing, introduction of collaborative robots
Agriculture	Autonomous harvesting robots, pesticide-spraying drones, livestock management robots
Construction	Automated welding robots, construction 3D printers, unmanned construction machinery
Energy	Power plant maintenance robots, wind turbine blade inspection robots
Logistics & Transportation	Unmanned warehouses, unmanned delivery robots, autonomous vehicles
Medical & Care	Surgical assistance robots, care robots, rehabilitation support robots
Commercial & Services	AI customer service robots, food delivery robots, guide robots
Safety and Disaster Prevention	Disaster rescue robots, surveillance and patrol robots
Education and Research	AI-equipped educational robots, experimental robotic arms
Home Life	Cleaning and household robots, care and health management robots

7.4.3. Space Industry

The Chinese government published the "Aerospace White Paper (2021)," outlining the nation's space development plans for the next five years. In addition, the National Medium- and Long-Term Plan for Space Science in China (2024–2050) sets the objective of becoming a leading global space science power and provides a three-step roadmap to achieve this goal. In 2022, China completed construction of its space station, Tiangong, and has since advanced research in space medicine, life sciences, and new technologies in microgravity environments. The lunar exploration program, Chang'e, aims for a manned lunar landing by 2030. The Mars exploration program, Tianwen, plans follow-up missions to Tianwen-1, which successfully landed on Mars in 2021. By 2030, the "Lunar Base Concept" envisions a joint lunar research base built by China and Russia.

(1) China's Space Program: A 2021 Perspective

1) Background

Since 2016, China's space program has made steady progress, including completing the basic framework for the BeiDou Navigation Satellite System and the China High-Resolution Earth Observation System. Satellite communication and broadcasting capabilities have also been steadily enhanced. China has successfully executed the three-step lunar exploration project—orbiting the Moon, landing on the Moon, and returning to Earth—and initiated the construction of its space station. Over the five-year period starting in 2021, China's space program is entering a new development phase. The release of the 2021 Aerospace White Paper aims to outline major challenges in space activities and provide the international community with a clearer understanding of China's space industry.

2) Key Contents

The "Aerospace White Paper 2021" details future objectives, emphasizing technological innovation, international cooperation, the promotion of commercial space development, and sustainable space utilization.

Categories	Item	Main Content
Future Goals	Lunar Base Program	From the late 2020s to the 2030s, China plans to construct a lunar base, pioneering a new frontier in space exploration.
	Deep Space Exploration	Exploration of celestial bodies other than Mars (such as asteroids and outer planets) is identified as a key future focus.
	Enhancing Manned Space Activities	Expanding the Tiangong Space Station to enable more long-term stays and scientific experiments.
Achievements in Space Development	Development of the Long March Rockets	The success of the Long March series, including the launch of the Long March 5B, is a key testament to the advancement of rocket technology.
	Tiangong Space Station	Construction of China's independent space station, Tiangong, is progressing. The Tianhe core module was launched into orbit in 2021. Additional modules will be added in the future, with plans to intensify manned space activities.
Expansion of Space Exploration and Scientific Research	Lunar Exploration Program	Progress continues through the Chang'e series, with a major milestone achieved in 2020 when Chang'e-5 returned lunar samples, advancing lunar exploration technology.
	Mars Exploration Program	The Tianwen-1 mission successfully landed and deployed a rover on Mars in 2021, showcasing China's progress in space technology.
Promotion of the Commercial Space Industry	Private Sector Participation	Progress is being made in the launch of small satellites by private companies and the provision of commercial satellite services. Private sector participation is promoting diversification and competition within the space industry, expanding commercial utilization.
International Strategy	Strengthening International Space Development Cooperation	Cooperation is expanding, particularly with countries in Asia, Africa, and Europe. Plans include sharing space technology, promoting joint exploration projects, and collaborating on the International Space Station (ISS).
Sustainable Space Activities	Addressing Space Debris and Protecting the Space Environment	Policies aimed at sustainable space utilization have been outlined, promoting research on satellite orbit management and space debris recovery technology.

(2) National Medium- and Long-Term Plan for Space Science in China (2024–2050)

1) Background

In October 2024, the Chinese Academy of Sciences, the China National Space Administration, and the China Manned Space Project Agency jointly released the "National Medium- and Long-Term Plan for Space Science in China (2024–2050)." This is the first national-level medium- and long-term plan for the space science field in China. The plan provides a framework for advancing space science and exploration from 2024 to 2050, with the objective of positioning China as a global leader in these fields.

2) Key Objectives

Objectives	Content
Exploring the Extremes of the Universe	Investigate the origin and evolution of the universe and elucidate the physical laws governing extreme conditions.
Unraveling the Ripples of Space-Time	Detect low-frequency primordial gravitational waves and probe the nature of gravity and space-time.
Unraveling the Relationship Between Earth and the Sun	Explore the Sun, Earth, and the heliosphere to uncover the laws governing their complex interactions.
Searching for Habitable Planets	Evaluate the habitability of planets within and beyond the solar system to identify those potentially capable of supporting life.
Investigating the Laws of Life in Space	Study the motion of matter and life processes in space environments to deepen understanding of fundamental physics and life sciences.

3) Roadmap

To achieve the aforementioned five major goals, a three-phase roadmap has been established.

Phase	Content
Phase 1 (2024–2027)	Maintain operations of the Tiangong space station and conduct manned lunar exploration.
	Launch the lunar exploration satellites Chang'e-7 and Chang'e-8.
	Finalize plans for the Mars exploration mission.
	Approve and implement 5–8 space science missions.
Phase 2 (2028–2035)	Expand and continue operation of the Tiangong space station.
	Commence construction of the International Lunar Research Station (ILRS).
	Implement the Tianwen-4 mission to explore Jupiter and Uranus.
	Conduct missions to explore the edge of the solar system and perform sample return from Venus's atmosphere.
	Deploy approximately 15 space science missions.
Phase 3 (2036–2050)	Achieve groundbreaking results in fundamental research on the origin and evolution of the universe, the nature of space-time, the origin of the solar system and life, and human deep space exploration.
	Implement over 30 space science missions.
	Establish a leading global position in key fields of space science.

7.5 Evaluation of Industrial Policy

Under the Xi Jinping administration, China's industrial policy has evolved into a comprehensive national strategy. Structural reforms have focused on enhancing international competitiveness, establishing an independent technological innovation system, and fostering emerging and future industries. Policy slogans such as "Manufacturing Superpower," "Science and Technology Superpower," and "Digital China" reflect the integrated development of industry and science and technology. The administration's industrial policy is structured around three core pillars: state-led planned guidance, concentrated resource allocation to key sectors, and the promotion of self-reliance and self-strengthening. Moving beyond conventional comparative-advantage-based policies, key initiatives have included:

- **"Made in China 2025"**: A national strategy (announced in 2015) aimed at advancing and modernizing manufacturing
- **Deepening the "Strategic Emerging Industries" policy**: Fostering sectors such as biotechnology, new energy, new-energy vehicles and next-generation communications
- **"Internet +" policy**: Driving industrial transformation through the integration of ICT and traditional industries
- **"Dual Circulation" strategy**: Enhancing economic self-reliance through domestic demand-led growth and strengthening domestic supply chains (2020–present)
- **"Eight Major Emerging Industries" and "Nine Major Future Industries"** : Cultivating innovation-driven next-generation industries (2023–present)

These policies are primarily formulated by the State Council, the National Development and Reform Commission, the Ministry of Industry and Information Technology, and other agencies. Implementation relies on subsidies, tax incentives, industrial investment funds, and technological development support.

(1) Achievements

1) Advancement of Manufacturing and Infrastructure

China has become the world's leading manufacturing hub, with significant global market shares in products such as smartphones, electric vehicles (EVs), solar panels, and 5G equipment. Since the launch of "Made in China 2025," advanced equipment manufacturing and robotics industries have grown substantially, expanding the base of high-end manufacturing. The development of advanced infrastructure, including 5G networks and intercity high-speed rail, has further supported economic growth.

2) Accelerating Scientific and Technological Innovation

China has increased investment in basic research, strengthening its presence in fields such as quantum communication, AI, space development, and biotechnology. The reorganization of national key laboratories and the establishment of the National Laboratory System have enhanced R&D capabilities in strategic technology areas. China is now a leading global contributor to research publications and patents, particularly in AI, quantum computing, and biomedicine.

3) Growth of the Digital Industry

Aligned with the "Digital China" strategy, sectors such as the platform economy, cloud computing, IoT, and smart cities have experienced significant growth. Companies such as Tencent, Alibaba, Huawei, and ByteDance have expanded their global presence, increasing China's influence in the digital economy.

While these achievements in economic growth, industrial modernization, and technological innovation are notable, numerous challenges remain.

(2) Challenges

1) External Constraints: U.S.–China Technology Friction and Global Environmental Changes

Technology tensions with the United States have caused significant supply chain disruptions for strategic goods such as semiconductors and telecommunications equipment. Sanctions against Huawei and restrictions on access to advanced chips have directly affected related Chinese industries, underscoring the urgent need to increase domestic production capabilities.

2) Strong "Government-Driven" Policy and Distorted Resource Allocation

State-led industrial policies enable rapid, large-scale development, but they also pose challenges, including the neglect of market mechanisms, redundant investment, and inefficient resource allocation. In the electric vehicle sector, for example, waves of overproduction, intense price competition, and subsequent consolidation highlight the risks of policy-driven approaches.

3) Regional and Corporate Disparities

Industrial infrastructure development in central, western, and rural regions lags behind that in eastern coastal areas, widening regional disparities. Gaps in technological capability and access to funding also persist between state-owned and private enterprises, emphasizing the need for institutional designs that fully unlock private-sector creativity.

4) Stagnation in International Collaboration with Western Nations

Although China's technological capabilities are advancing rapidly and cooperation with Global South countries is active, collaboration and joint research with Western nations have stalled due to heightened geopolitical tensions. Barriers include concerns over intellectual property protection and opaque data regulations, limiting Chinese participation in global innovation networks.

Looking forward, China's industrial policy must balance sustainability with cutting-edge advancement, focusing on "national strategic technological self-reliance," "high-quality development," and the creation of "new-quality productive forces." Targeted investment is expected to continue in the "Nine Major Future Industries," including generative AI, brain–machine interfaces, 6G, and bio-manufacturing. At the same time, institutional reforms are needed to unleash private-sector innovation, redefine the roles of the market and government, and ensure alignment with international norms and rules.

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8 Policies for Enhancing National Competitiveness

China's science and technology innovation (STI) policy is aimed at going beyond merely strengthening its domestic technological capabilities. It is being implemented as a core element of national strategy, integrated with diplomacy, economics, and security. China's global strategy policies constitute the framework it will use to expand its influence in the international community and to participate in, and lead, the formation of a global scientific and technological order. This chapter focuses on the "Belt and Road Initiative" (BRI), the "Guidelines to encourage the launch of more international big science projects," the concept of a "community with a shared future for mankind," and China's "global governance initiative."

The BRI is widely recognized as the foundation of China's current foreign economic strategy, and its core lies in promoting scientific and technological cooperation. Through the "Silk Road Science and Technology Innovation Partnership Initiative," China is pursuing joint research, technology transfer, and talent training with participating countries to establish a China-centered STI network. These actions represent China's attempt to strengthen its technological capability through cooperation and to distribute that capability globally.

China has also been active in joining and taking the lead in international "big science projects" in fields such as space development, quantum communication, climate change, and particle physics. The "Guidelines to encourage the launch of more international 'big science' projects," released in 2023, clearly state China's desire to shape international norms and serve as a hub for research and development in the field of science and technology, extending the "openness and cooperation" strategy of its STI policy. This highlights China's ambition to shift from merely a participant to a rule-maker and leader.

"A community with a shared future for mankind" is a diplomatic concept proposed by President Xi Jinping. The concept stresses the need for multiple communities to jointly address global challenges in the fields of science and technology, such as the Sustainable Development Goals (SDGs), climate change countermeasures, and infectious disease control. Through this idea, China is pursuing "inclusive and equitable" technological development through international scientific cooperation and seeks to position its STI policy as part of a redefined international order.

8.1 The Belt and Road Initiative

The BRI is a massive economic zone concept proposed by Xi Jinping in 2013. As part of this concept, China has been expanding its infrastructure investment, primarily through the "Silk Road Economic Belt" (land route) and the "21st Century Maritime Silk Road" (sea route), promoting the construction of railways, ports, roads, and energy facilities to advance economic development and strengthen China's international influence. Although over 150 countries have already signed agreements under the BRI, the initiative faces challenges such as debt issues and geopolitical conflict.

(1) Background

The BRI economic zone project spans Asia, Europe, and Africa and has been promoted by China since 2013. Initially, as part of the project, China called for strengthened cooperation with Asian and ASEAN countries, aiming to counteract the Trans-Pacific Partnership Agreement, support inland regions, resolve excess capacity, and address inventory problems stemming from the "RMB 4 trillion stimulus package" by tapping into overseas demand.

(2) Key BRI projects

Category	Title	Purpose and Role
Silk Road Economic Belt	China–Europe Railway	Strengthening the freight transportation network
	China–Pakistan Economic Corridor	Transportation route connecting China and Pakistan
	Central Asia Oil and Gas Pipeline	Securing energy supply
21st Century Maritime Silk Road	Hambantota Port, Sri Lanka	China developed port infrastructure and secured a 99-year operating concession.
	Piraeus Port, Greece	The Chinese state-owned enterprise COSCO purchased the port, making it the gateway to the European market.
	Kuantan Port, Malaysia	Developed as a trade hub for Southeast Asia.

(3) BRI achievements and challenges

In 2023, China marked the 10th anniversary of the BRI launch. In October of that year, the Third Belt and Road Forum for International Cooperation was held in Beijing to commemorate this anniversary and to summarize the achievements of the past decade.

1) Achievements

First, China signed over 200 cooperation documents on Belt and Road development with 152 countries—representing 83% of the nations with which China maintains diplomatic relations—and 32 international organizations. Second, by promoting the interconnection of six major international economic corridors and surrounding infrastructure, China successfully constructed the China–Europe Railway, the Western Land–Sea Transportation Corridor, the China–Laos Railway, and the Jakarta–Bandung High-Speed Railway. Third, a new financial system was developed, and financial cooperation expanded through the provision of financial services and innovation in investment and lending systems.

Trade volume with countries along the Belt and Road route also increased rapidly. According to China Customs Import & Export Statistics, exports to BRI partner countries as a percentage of China's total exports rose from 34.8% in 2012 to 42.7% in 2022, while imports increased from 43.8% to 49.0%. From 2013 to 2022, the cumulative total value of trade between China and BRI partner countries reached USD 13 trillion, with an average annual growth rate of 8%. This USD 13 trillion figure represents 30% of the total value of external trade. Cumulative mutual investment also exceeded USD 270 billion. The industrial and supply networks among the countries and regions involved in the BRI also became more closely integrated, increasing the proportion of intermediate goods exported to these countries to 56%. The increase in these networks can largely be attributed to ASEAN countries. China's trade dependency on

ASEAN countries rose significantly from 2015, when it launched its free trade agreement (FTA) strategy as part of the BRI. Through the FTA strategy, a virtuous cycle emerged, in which capital flowed from China to ASEAN countries, inducing trade.

China's political and diplomatic presence also expanded significantly among BRI partner countries, particularly among developing nations. For example, in June 2021, during a joint statement expressing concerns about the human rights situation in the Xinjiang Uyghur Autonomous Region, the Hong Kong Special Administrative Region, and Tibet at the UN Human Rights Council, 68 countries defended China, 67 of which were BRI partner countries. At the very least, the BRI has succeeded in increasing the number of China's advocates.

2) Challenges

Although the economic benefits of the BRI have been recognized, China Customs Import & Export Statistics show that the share of China's exports and imports to BRI partner countries, excluding ASEAN and Russia, remained largely unchanged from 2012 to 2022. In fact, only a small number of countries have delivered the expected economic benefits. However, the debt crisis faced by some partner countries has been more serious than these low economic gains. In 2017, Sri Lanka's Hambantota Port, unable to repay loans from institutions including the Export-Import Bank of China, leased its operating rights to a Chinese state-owned enterprise for a 99-year term. This project drew intense criticism from abroad, with claims that it constituted a "debt trap." Recently, factors contributing to an economic downturn have increased, such as the spread of COVID-19 and rising inflation due to the situation in Russia and Ukraine. There is also a risk that the number of participating countries experiencing debt crises will increase significantly in the future. In response to these circumstances, China has been revising its financing terms, such as through interest rate reductions and exemptions, implementing debt relief measures, and supporting debt repayment by providing renminbi liquidity to developing countries with reduced foreign currency payment capacity through renminbi swap agreements with middle- and low-income countries, aiming to establish a "Renminbi Economic Zone."

China is also facing project risks due to the large number of participating countries with unstable political situations. Additionally, China's own economic growth has been slowing, making continued funding for BRI projects uncertain. The BRI has led to growing concerns among nations regarding China's expanding influence and has sparked geopolitical tensions. The United States is strengthening its Indo-Pacific strategy and working with some countries to contain China's influence. India, concerned about China's strategic containment, has refused to participate in the BRI.

8.2 Guidelines that Encourage the Launch of International "big science" projects (2018)

The Guidelines, reflecting the essence of the Xi Jinping administration's "Innovation-Driven Development Strategy," were established to enhance innovation capabilities and international influence in cutting-edge strategic fields and to strengthen China's presence in the global STI arena. The essence of these policy guidelines is the emphasis on "leadership" rather than merely "participation." China, which can play a significant role as a participating state in major international scientific projects, aims to transform itself into a leading force in the global scientific and technological community by 2035.

(1) Background

In March 2018, China's State Council set forth a plan to focus on research fields with a profound impact on human social development and scientific and technological progress, concentrate domestic and international strengths, and actively lead international big science projects. This plan aimed to enhance innovation capabilities and international influence in cutting-edge strategic fields, create new platforms for open cooperation in innovation, and build and advance a new global innovation governance structure and a community with a shared future for all. The policy provided strong support for building an innovation-driven nation and creating global leadership in science and technology, thereby making a significant contribution to great power diplomacy with Chinese characteristics.

(2) Three-stage roadmap

Following these guidelines, the Chinese government defined its objectives as: 1) spearheading and organizing big science projects to carry out high-level scientific research in fields at the forefront of global science and technology and economic and social development, while fostering top-tier scientific and technological talent; and 2) forging an international consensus, enhancing collaborative innovation capabilities, becoming proponents, promoters, and formulators of major international science and technology agendas and rules, and strengthening competitiveness and presence in the global STI arena. To achieve these objectives, the following three-stage roadmap was formulated:

Stages	Roadmap summary	Goals to be achieved
Short-term goals	By 2020, prepare three to five projects and develop, select, and launch one to two big science projects led by China.	Develop mechanisms and share best practices for leading and organizing big science projects at an early stage, thereby accumulating valuable experience beneficial for pursuing program implementation.
Mid-term goals	By 2035, prepare 6 to 10 projects and begin advancing qualified projects.	Construct the initial portfolio of big science projects led by China and strengthen China's influence in several fields of science and technology worldwide.
Long-term goals	By mid-century, prepare multiple projects and begin launching full-fledged projects.	Significantly enhance China's capability for STI, play a vital role in the international governance system for innovation, and continue to contribute to addressing major global scientific and technological challenges.

(3) Key missions

	Key missions	Project direction for mission achievement
1	Develop strategic plans based on China's existing foundation, identify priority areas, and align them with current dynamics in cutting-edge strategic fields.	Organize and formulate plans, establish development roadmaps considering priority directions, potential projects, key construction initiatives, and organizational mechanisms in fields such as material sciences, cosmic evolution, origins of life, and Earth systems, and systematically advance each project according to scientific logic.
2	Robustly organize the selection, logical description, development, and presentation of each project, and ensure its initiation and full implementation.	Identify multiple potential aspects for cooperation within a project and prioritize and implement them accordingly. Put forward relevant international proposals and, through consultations and negotiations, finalize projects for initiation and implementation. Ensure alignment and coordination with nationally important research portfolios, and effectively maintain consistency with domestic programs such as the "Science, Technology, and Innovation 2030 Major Projects."
3	Establish management mechanisms tailored to the project's characteristics.	Jointly mobilize resources in internationally influential institutions, such as national laboratories, scientific research institutions, universities, and science and technology societies, and organize specialized scientific research institutions, corporations, and intergovernmental organizations to plan, create, and operate big science projects.
4	Take part in big science projects proposed by other countries and actively share their missions.	Engage in the operational management of these projects, maintain positive relationships through mutual complementarity and support, and ensure effective synergies with the international big science projects led and organized by China.

8.3 The Community with Shared future for Mankind Concept and the Global Governance Initiative

During the Xi Jinping administration, China proposed the principles of "cooperation over confrontation" and "co-governance over domination" to expand its influence in the international community and participate in shaping new international rules. A community with a shared future for mankind is a vision that calls for cooperation across borders and for all humanity to jointly enjoy prosperity and peace, whereas "global governance" refers to the idea that the international order should be multilateral, multipolar, and equitable rather than Western-led, and that it should particularly respect the voices and interests of developing countries. As such, China's ambition to become a central power in the new world order is strongly embedded in this vision.

8.3.1 Concept of a community with a shared future for mankind

(1) A community with a shared future for mankind

Xi Jinping first proposed the concept of a "community with a shared future for mankind" in a speech at the Moscow State Institute of International Relations in March 2013. Since then, China has repeatedly advocated this concept at events such as the 2017 UN General Assembly and the World Economic Forum, defining it as one of the diplomatic principles that China is championing in the international community. Similar to the BRI, it emphasizes common prosperity and coexistence. Some observers have pointed out that this poses a challenge to a U.S.-led order.

(2) Definition and content of a community with a shared future for mankind

At the 19th National Congress of the Communist Party of China held in October 2017, Xi Jinping stated, "Based on the concept of a community with a shared future for mankind, China will advance the building of a new international order through great power diplomacy with Chinese characteristics." Thereafter, the concept of a "community with a shared future for mankind" was formally incorporated into policy documents such as the constitutional amendment proposal (2018), the National Defense White Paper (2019), and the Foreign Relations Act (2023).

This concept is defined as one in which "all nations consult together on global issues, build a governance system, and share the benefits." Specifically, it emphasizes that "the future and destiny of all ethnic groups, nations, and individuals are closely intertwined, so that humankind should cooperate beyond national interests and differences of civilization to jointly build a peaceful and sustainable future." As globalization advances, this implies that all humanity should cooperate to address challenges such as sluggish economic growth, climate change, and infectious diseases.

The five pillars supporting this concept include:

1) Political coexistence: mutual respect and equal partnership
2) Jointly building security: collective security and a dialogue-based approach
3) Economic win-win cooperation
4) Cultural exchange and coexistence
5) Eco-civilization: environmental protection and measures against climate change

(3) Perception and recognition of the concept

As a counter to the value-based diplomatic principles of Western nations—such as "freedom, democracy, and human rights" —China has placed value neutrality at the forefront, emphasizing "mutual benefit, equality, and respect for the right to development." In a February 2021 resolution of the UN Human Rights Council, wording related to a "community with a shared future for mankind," led by China, was used in a UN resolution for the first time. Subsequently, references to a "community with a shared future for mankind" have appeared with increasing frequency in documents from the UN Economic and Social Council and the UN Development Programme.

ASEAN countries, such as Thailand, Laos, and Cambodia, have adopted a "strategically balanced approach," while prioritizing economic cooperation and showing relatively favorable responses to the concept of a "community with a shared future for mankind." The U.S. views China's strategy as a slogan aimed at forging a China-centered international order and has taken a vigilant stance, warning that China poses a challenge to the rules-based international order. In the case of the EU, dialogue with China on cooperation related to climate change and other issues requiring global efforts is prioritized, but a confrontational stance has not been adopted. Instead, the EU has maintained a prudent approach, balancing economic dependence with strategic autonomy. In the Global South, encompassing Africa and Latin America, there is a certain degree of sympathy, partly due to the investment and infrastructure construction provided by China. In countries seeking to avoid interference from Western nations, China's principles of "non-interventionism and prioritizing development" are welcomed. However, issues of accountability and lack of transparency associated with support for the BRI risk contradicting the concept of a "community with a shared future for mankind," and dispelling such doubts remains a challenge.

8.3.2 China's global governance initiative

(1) Background

In January 2017, Xi Jinping attended the Davos Forum and publicly articulated his vision for "reforming global governance" and "building an open world economy." In September 2021, China proposed the "Global Digital Governance Initiative," stating its intent to assert sovereignty and promote norm-setting in the digital sphere, AI, and cyberspace under Chinese leadership.

The China-led global governance initiative emphasizes its differences from Western values and systems by highlighting keywords such as "multilateralism," "inclusiveness," and "respect for the right to development." This approach demonstrates respect for diversity within the international order, but is strategically aimed at expanding China's influence and restructuring the existing Western-oriented order.

(2) Key contents

Vision	Contents
Focus on multilateralism	Emphasizing support for a UN-centered international order and opposing hegemony and unilateralism.
Respect for national sovereignty and non-interventionism	Emphasizing the freedom of nations to choose their own systems and opposing external intervention in the name of democratization or human rights, while recognizing the diversity of values in the formation of international rules.
Economic development as the top priority	Addressing climate change, digital sectors, AI regulation, and other areas according to their respective stages of development, and proposing the redesign of rules and frameworks to meet the development needs of the Global South.
Humanity sharing destiny for a common future	Advocating, across all areas—security, economy, technology, and others—that all nations are interrelated and interconnected and that their destinies are inseparable. Emphasizing the principle of cooperation over confrontation and unity over division, and advancing China's desire to take the lead in establishing rules based on this principle.
Assuming leadership in the field of science and technology	Stressing the importance of "fair rule-making" in the fields of AI, big data, and the digital economy.

8.4 Policies to Enhance International Competitiveness

Under Xi Jinping's administration, China has launched a series of global strategies to bolster its international influence and competitiveness, including the following:

- The BRI: Proposed in 2013, it is aimed at building a broad economic zone connecting Asia, Africa, and Europe.
- International big science projects: Proposed to create and lead international projects in cutting-edge scientific fields, positioning China at the center of global research networks.
- A community with a shared future for mankind: Presented as a diplomatic strategy that prioritizes cooperation and coexistence over geopolitical confrontation.
- Global Governance Initiative: Promoted to drive a shift from the existing Western-centric rule-making

system to a China-led multipolar order.

These strategies comprehensively integrate diplomacy, economics, science and technology, and security to advance China's rise as a major power.

(1) Status quo

1) Progress of the BRI

Within the BRI framework, cooperation agreements with over 150 countries have been concluded, and many large-scale projects in railways, ports, telecommunications infrastructure, and other areas have been launched. For instance, the China–Europe Railway Express, a rail network connecting China and Europe, has become important in reducing transportation time in trade and improving logistics efficiency.

The BRI has also created new areas such as the Digital Silk Road and the Green Silk Road, leading to the internationalization of Chinese standards through infrastructure construction, driving cross-border RMB settlement, and exporting 5G, AI, and other technologies.

2) Securing leadership in international big science projects

China has expanded its presence as a major scientific and technological power through participation in projects such as the quantum communication satellite Micius, FAST, the world's largest radio telescope, and ITER, the nuclear fusion project. Additionally, China is taking the lead in international cooperation initiatives in fields such as AI, quantum information, and space development, aiming to develop new research collaboration models outside frameworks led by the G7 and the OECD.

3) Promoting the global governance initiative

China has expanded its influence within existing international institutions, such as the UN, WTO, and WHO, while simultaneously launching new multilateral institutions, including the Asian Infrastructure Investment Bank (AIIB) and the New Development Bank (NDB). These initiatives serve as a means of strengthening cooperation with developing countries by leveraging China's international credibility and financial clout.

4) Penetration of the concept of a "community with a shared future for mankind"

This concept has gained some favorable support, particularly in Global South countries. During the COVID-19 pandemic, China enhanced its humanitarian public profile through initiatives such as providing free vaccines and promoting the "Health Silk Road."

(2) Challenges

1) The risk of debt

Criticism persists that infrastructure development under the BRI leads to increased debt in host countries, with the initiative being labeled "debt trap diplomacy." As symbolized by the case of Sri Lanka's Hambantota Port, questions have been raised regarding the governance and transparency of China's lending practices.

2) Friction with the international community

Trade tensions and economic security issues, particularly in the high-technology sector, have intensified between China and Western countries, limiting China's ability to gain an upper hand within the framework of international cooperation. Moreover, the Chinese model of global governance is often criticized as "authoritarian."

3) Gaining international trust in the field of science and technology

China-led scientific and technological cooperation is consistently accompanied by concerns over intellectual property protection, research ethics, and military–civil fusion. Consequently, joint research and personnel exchanges with developed countries are often restricted.

4) The ambiguity of the concept of a "community with a shared future for mankind"

The concept of a "community with a shared future for mankind" has been criticized as ill-defined and difficult to translate into concrete policy measures. International understanding of the concept has not necessarily deepened, and an institutional design is required to ensure an effective means of translating it into practical actions.

Going forward, to enhance its presence in the global STI arena, China will need to ensure transparency and responsibility in international cooperation, particularly in the field of development assistance; build credibility in science and technology cooperation, including intellectual property protection and information sharing; improve its rule-making capacity in global governance through accommodation with existing regimes; and concretize the concept of a "community with a shared future for mankind" while building international consensus.

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9 Scientific and Technological Innovation Achievements and Challenges as Reflected in Policy Documents

This report concludes by discussing China's achievements in science and technology innovation since its founding, as well as the challenges it is currently facing, as summarized from Chinese government policy documents.

9.1 Achievements

Marking the 75th anniversary of the founding of the People's Republic of China, the achievements in science and technology innovation, as reported by the National Bureau of Statistics of China, are as follows.

Achievement 1. Development and maturation of China's national science and technology innovation system

(1) Establishment of a strategic position

Since its founding, China has placed science and technology at the core of its national strategy, formulating long-term plans for each era. Its first national science and technology development plan was created in 1956. However, since the country began its reform and opening up, it has emphasized linking science and technology with the economy. The "National Medium- and Long-Term Program for Science and Technology Development (2006–2020)" emphasizes strengthening basic research and establishing independent technological capabilities.

(2) Formation of a multi-dimensional collaborative innovation system

Since the establishment of the Chinese Academy of Sciences in 1949, the number of research institutions in the country has rapidly increased. After the reform and opening up, the link between science and technology and the economy advanced through institutional reforms, the promotion of private-sector participation, and military¬¬–civil integration. Recently, national laboratories, research universities, and cutting-edge companies have emerged as drivers of innovation.

(3) Systematization of the national key science and technology program

Beginning with the consolidation of key issues in 1956, each subsequent plan has strategically addressed scientific and technological challenges. After the "973 Plan," the "863 Plan," and others, the framework was reorganized in 2015 into the current five categories.

(4) Strategic enhancement of basic research

After achieving breakthroughs in areas such as atomic bombs, rockets, and synthetic insulin, China subsequently strengthened its research capabilities in cutting-edge fields such as quantum, nano, and synthetic biology. The construction of large-scale research facilities, such as the Five-hundred-meter Aperture Spherical Radio Telescope (FAST) and the Experimental Advanced Superconducting Tokamak (EAST), also significantly improved basic research capabilities in areas such as space exploration and nuclear fusion.

Achievement 2. Accelerating the accumulation of science and technology innovation resources

(1) Historical expansion of R&D investment

China's R&D investment in 2023 reached 3.3 trillion yuan, 233 times its 1991 level. The R&D ratio, which is the proportion of research and development expenditure to gross domestic product (GDP), also rose to 2.64%, approaching the OECD average. China has now become the world's second-largest investor in R&D after the United States.

(2) Sustainable growth in human resources

As of 2020, 23.6% of China's population had a university degree or higher. The number of people working in R&D also expanded ten-fold since 1991, reaching 7.24 million people in 2023—the highest in the world.

(3) Strengthening financial and tax support

China's science and technology budget expanded to 1.1 trillion yuan in 2022. For companies, the tax deduction system for research expenses (additional tax deduction) also expanded, with 1.85 trillion yuan applied for in 2023.

(4) Formation of a multi-layered science and technology financial system

Fundraising methods tailored to different research stages, from start-up to growth (e.g., the Science and Technology Innovation Board [the Shanghai Stock Exchange (SSE)] and the New Third Board [China's over-the-counter market, the National Equities Exchange and Quotations (NEEQ)]), as well as stronger bank lending, have advanced. By the end of 2023, total loans to high-tech companies reached 13.6 trillion yuan.

(5) Expansion of innovation support services

The technology trading market grew to 6.1 trillion yuan in 2023. More than 6,600 incubators have been established across the country, supporting more than 320,000 companies.

Achievement 3. Succession of major science and technology accomplishments

(1) Results in basic and cutting-edge science

China has achieved unique results in the quantum, life, and material sciences (e.g., proof of geometric conjectures, cellular reprogramming, and artificial starch synthesis from CO2), as well as in space, deep-sea, and underground exploration.

(2) International presence through papers and patents

China ranks first in the world in terms of the number of papers published in SCI journals and second in terms of the number of citations. In 2023, its number of valid invention patents exceeded four million, marking a world first.

(3) Manifestation of industrial application accomplishments

Achievements in 5G and 6G communication, large-scale AI models, agricultural breeding, and new drug development are accelerating. By 2023, nearly 150 new Class 1 drugs had been launched.

Achievement 4. Contribution to high-quality economic development

(1) Strengthening the role of companies

Corporate R&D investment in 2023 reached 2.6 trillion yuan, accounting for over 75% of total R&D investment. The number of Chinese companies on the "Global Top 2500 R&D" list also expanded from 199 in 2013 to 679 in 2022.

(2) Advancement of industrial structure

The "Three New" (new industries, new business formats, and new business models) economy accounted for 17.73% of GDP in 2023, whereas patent-intensive industries accounted for 12.7%. Over the past 10 years, sales of new products have increased, on average, by 10.7% annually. Digital transformation, including the development of smart factories, has also accelerated.

(3) Improvement in international competitiveness

Trade in high-tech products reached USD 1.7 trillion in 2023, and the proportion of knowledge-intensive sectors in trade in services also increased. China has established a strong position in the global market for solar panels, batteries, and other products.

Achievement 5. Contribution to national strategy

(1) Promotion of regional cooperation and common development

More than 200,000 companies are concentrated in 178 national-level high-tech industrial zones across the country. Beijing, Shanghai, and the Guangdong–Hong Kong–Macao Greater Bay Area have emerged as international innovation centers.

(2) Promotion of innovation with a focus on helping people

China has introduced innovative systems for new drugs and infectious disease countermeasures. Practical application of mRNA vaccine technology is advancing and is being applied to address emerging diseases, such as the respiratory syncytial virus.

9.2 Challenges

Although China's public policy documents, including the 2024 Government Work Report, detail the many achievements summarized above, the report also points out that China's science and technology sector continues to face several challenges.

First, China's science and technology innovation capacity is not sufficiently robust in terms of quality when compared with external growth indices. In particular, significant vulnerabilities have been noted in the accumulation of basic research, which should be at the core of the science and technology system, and in the creation of primitive innovations, namely highly original breakthroughs, based on such research. These elements are critical for breaking away from technological development that relies on imitation and application and for building an original technological system. However, many observers believe that China has not yet reached this level.

Second, institutional and structural barriers have been identified as factors hindering the sustainable growth of science and technology innovation. In the industrialization of research results, a significant gap exists between basic and applied research, and the process from laboratory discoveries to technological applications in the market remains inefficient. This stagnation in technology transfer, often referred to as the "Valley of Death," constitutes a major obstacle to the effective utilization of research resources.

Third, the lack of innovation leadership among Chinese companies cannot be overlooked. Many firms prioritize short-term profits over allocating sufficient resources to long-term investment in basic technologies or to the establishment of robust research and development systems. Consequently, industry has not fully played a leading role in the national science and technology strategy.

Fourth, the mechanisms for collaboration between universities or research institutions and companies, namely industry–academia collaboration, remain immature and fail to effectively match mutual needs and resources. This is a complex issue involving multiple factors, including the handling of intellectual property, the distribution of research funding, and inadequate mechanisms for sharing outcomes.

Ultimately, the most significant challenge facing China's science and technology innovation going forward is achieving stronger qualitative outcomes while simultaneously expanding results quantitatively. Setting policy goals or increasing investment alone is insufficient; essential efforts are required in areas such as institutional reform, human resource development, and the fostering of a robust research culture.

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