Research on the Strategy-Policy System for Science and Technology Innovation: Proposal and Analysis of the "3+5" Framework (Postprint)

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Abstract

Science and technology innovation strategies and policies, as important instruments for promoting national scientific and technological development, are advancing toward multi-dimensional "synergistic effects"across science and technology, economy, society, and environment, requiring comprehensive consideration of numerous internal and external elements that both promote development through science and technology and promote the development of science and technology. To this end, an integrated science and technology policy architecture encompassing key elements and their interactions should be constructed. This article proposes the "3+5"science and technology innovation strategy-policy framework system (hereinafter referred to as the " '3+5' framework system") and conducts theoretical and practical analysis to provide a policy analysis framework for decision-making departments and policy researchers. Specifically, it includes: (1) Defining the conceptual connotation of the "3+5" framework system, establishing a "design layer" comprising policy strategies, planning layouts, and institutional arrangements, and a "construction layer"comprising innovation entity policies, resource allocation policies, science and technology talent policies, achievement transformation policies, and environment cultivation policies; (2) Elucidating the construction logic of the "3+5" framework system from the perspectives of functional dimensions and value orientation; (3) Taking China' s strategic layout for science and technology innovation as the object of examination, conducting policy analysis based on the "3+5" framework system.

Full Text

Preamble

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Abstract

As an important means of promoting national scientific and technological development, science and technology (S&T) innovation strategy and policy are advancing toward multidimensional "synergistic effects" spanning S&T, the economy, society, and the environment. This evolution requires comprehensive consideration of numerous internal and external elements that both promote development through S&T and foster S&T development itself. To this end, an overall S&T policy architecture encompassing key elements and their interactions should be constructed. This article proposes a "3+5" framework for S&T innovation strategy and policy (hereinafter referred to as the " '3+5' framework") and conducts theoretical and practical analysis to provide a policy analysis framework for decision-making departments and policy researchers. Specifically, the study includes: (1) defining the conceptual connotation of the "3+5" framework, establishing a "design layer" comprising guiding strategy, planning layout, and institutional arrangement, and a "construction layer" comprising policy on innovative actors, policy on resource allocation, policy on S&T talent, policy on achievement transformation, and policy on environment cultivation; (2) elaborating the construction logic of the "3+5" framework from the perspectives of functional dimensions and value orientation; and (3) examining China' s strategic layout for S&T innovation and conducting policy analysis based on the "3+5" framework.

Keywords: world power in science and technology, S&T innovation, strategy, policy, "3+5" framework

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The accelerated evolution of the new S&T revolution and industrial transformation has intensified international S&T competition, leading governments worldwide to increasingly recognize the critical role of S&T innovation strategy and policy in advancing national scientific and technological progress. Countries have promptly formulated and dynamically adjusted relevant policies to provide comprehensive support for S&T innovation. This has resulted in a shift

from short-term project funding to long-term strategic layout, from R&D support alone to achievement transformation and industrial cultivation, and from single policies to policy "combinations." Meanwhile, nations worldwide face challenges including unclear positioning, poor coordination, and even conflicts among multiple S&T innovation strategies and policies. To comprehensively and systematically understand the structure, function, and evolution of S&T innovation strategy and policy, and to systematically analyze the practice and effectiveness of existing S&T innovation strategy and policy systems, this article builds upon the National Natural Science Foundation of China' s Emergency Management Science Department project "Policy Research on Responding to the New S&T Revolution and Industrial Transformation Process" [1] to deepen theoretical research. From the perspectives of functional dimensions and value orientation, we propose the "3+5" framework for S&T innovation strategy and policy (hereinafter referred to as the " '3+5' framework"), explain the inherent logic of this system, and examine China' s S&T innovation strategic layout as an analytical object to investigate the evolution of its policy system in the process of achieving S&T modernization and building a world S&T power.

1. Conceptual Connotation: What Is the "3+5"Framework?

1.1 Innovation-Driven Development: S&T Innovation Strategy and Policy System as the "Boat"and "Bridge"for Achieving Breakthroughs

Since the reform and opening up, China has achieved globally remarkable economic success, becoming the world' s second-largest economy. However, this past high-speed growth relied primarily on factor-driven models such as labor intensity and land dividends, as well as investment-driven models like active foreign capital introduction, resulting in low economic development quality and efficiency, severe ecological environmental damage, and insufficient innovation capacity [2]. In recent years, as China has entered the ranks of middle-income countries and faced intensified great-power competition, the momentum from factor and investment drivers has declined, necessitating a transformation of China' s economic growth model. General Secretary Xi Jinping emphasized in the 20th Party Congress report that "we must regard S&T as the primary productive force, talent as the primary resource, and innovation as the primary driver, thoroughly implementing the Strategy for Revitalizing the Country through Science and Education, the Strategy for Strengthening the Country through Talent, and the Innovation-Driven Development Strategy, opening up new fields and tracks for development, and continuously fostering new drivers and strengths for development." China' s economy has entered a transition period, shifting from factor-driven and investment-driven models to an innovation-driven model. This requires major original innovations, breakthroughs in key core technologies, and technology upgrades to cultivate and develop emerging and future industries, enabling industrial migration, transformation, upgrading, and expansion, thereby achieving leapfrog economic growth.

Achieving S&T breakthroughs requires a systematic S&T innovation strategy

and policy system to provide foundational support. Advancing S&T progress is a systematic project encompassing multiple innovation chain links such as basic scientific research, applied basic research, technology development, and product R&D, involving multiple actors including enterprises, markets, governments, and research institutions. Only through coordinated cooperation and common development among all links and different actors can breakthroughs in original innovation, key technologies, and system integration be accomplished. S&T breakthroughs urgently require innovative policy measures to achieve coordination among various links and unify the interests and values of different actors. For example, before the enactment of the Bayh-Dole Act in the United States, a considerable portion of basic research and technology development was government-funded, with research results owned by the government. This mismatch between resource allocation policy and achievement transformation policy caused misalignment between the goals of basic research and technology development departments and industrial needs, making it difficult to motivate research institutions to conduct market-relevant research [3]. The Bayh-Dole Act, born with the strategic mission of revitalizing U.S. S&T development and economic recovery, kept research result property rights with researchers, smoothed the transmission channel from industrial demand to research institutions, and mobilized researchers' enthusiasm for industry-relevant research, greatly improving the transformation rate of U.S. S&T achievements in a short period. This case demonstrates that S&T innovation policy is the specific tool for achieving S&T strategic goals, and that mutually adapted strategies and policies, along with realistic institutional arrangements, can greatly enhance S&T innovation effectiveness.

1.2 S&T Innovation Strategy-Policy System Without an Overarching Framework Struggles to Realize Policy Value

Regarding how to construct an S&T innovation strategy-policy system, the S&T policy community has mostly approached policy segmentation and system construction from different academic perspectives. Relevant research can be categorized into four types (Table 1): (1) Based on a tool perspective, introducing public management theory to categorize S&T innovation policies into supply-side, demand-side, and environment-side policies, positioning S&T innovation policies as authoritative allocation of public resources to achieve S&T progress and economic growth [4]. Supply-side, demand-side, and environment-side S&T policies respectively demonstrate supply push, demand pull, and indirect influence on S&T innovation activities. (2) Based on a process perspective, S&T innovation policies correspond to basic research, technology application, and experimental development policies [5]. Different S&T innovation policies act on the front, middle, and back ends of the innovation value chain. (3) Based on a hierarchical perspective, S&T innovation strategies and policies resemble a "pyramid" that can be divided into macro, meso, and micro levels with inherent interconnections [6]. (4) Based on a systems perspective, the national innovation system comprises typical innovative actors such as universities, re-

search institutions, and enterprises, as well as new types of R&D institutions, industrial technology research institutes, and industry associations, forming a "three layers and two circles" system architecture including the target demand layer, innovation practice layer, environment support layer, innovation opening circle, and system feedback circle [7].

Overall, existing research has focused on establishing S&T innovation strategy-policy frameworks from specific perspectives, lacking a macro-level, overarching framework. This results in unclear policy functional dimensions and pathways, neglect of different value orientations of S&T innovation strategies and policies, and difficulty in ensuring policy coordination and consistency, which is not conducive to decision-making departments' holistic grasp, overall design, and item-by-item implementation of the S&T innovation strategy-policy system.

1.3 Proposing the "3+5" Framework to Build an Overall Architecture for S&T Innovation Strategy and Policy

In the process of national S&T system reform and innovation, facing S&T innovation strategies and policies with extensive functional dimensions and diverse value orientations, how the government can consider all aspects and design comprehensively, and how to use policy innovation to promote S&T breakthroughs, still require systematic answers. To this end, this article proposes the "3+5" framework (Figure 1 [Figure 1: see original paper]). The "3" is positioned as the "design layer," including three key elements: guiding strategy, planning layout, and institutional arrangement; it plays a guiding role, mainly conducting top-level design of S&T innovation with strong comprehensiveness, determining the direction, implementation pathways, major tasks, major projects, and major measures of S&T innovation. The "5" is positioned as the "construction layer," including five key elements: policy on innovative actors, policy on resource allocation, policy on S&T talent, policy on achievement transformation, and policy on environment cultivation; it plays an instructive role with specific task assignments and particular target arrangements, mainly manifested as laws, policies, opinions, regulations, and measures targeting S&T innovation activities.

2. Construction Logic of the "3+5" Framework

2.1 Analysis of Functional Dimensions

The "design layer" acts at the macro level of national S&T development, establishing a "main bridge" connecting S&T development and S&T innovation serving economic and social development. (1) Guiding strategy addresses the overall issues between S&T development and national economic and social development and the connections among various objectives, serving as the overall and global program of the S&T policy system. (2) Planning layout represents long-term, phased plans formulated under the guidance of S&T development guiding strategy, making specific provisions and designs for the pathways, measures, and steps of S&T activities, and conducting advantageous integration

and overall arrangements in S&T development fields, development stages, resource allocation, and support conditions. (3) Institutional arrangement refers to the organizational system and institutional design of S&T activities under the guidance of S&T guiding strategy and planning layout. S&T institutional arrangements can effectively coordinate national-level and phased S&T resource allocation, cultivate innovative talent, enrich innovative actors, and effectively open up the "S&T innovation–economic growth" transmission channel from basic research to technology development to industrial application.

The "construction layer" acts at the micro level within and among innovative actors, representing the key chain and policy tools for S&T innovation driving high-quality economic and social development. (1) Policy on innovative actors sets differentiated positioning, responsibilities, and objectives for different innovative actors, including research universities, research institutions, and enterprises, and enhances national innovation system effectiveness through synergistic cooperation among different innovative actors [7]. (2) Policy on resource allocation distributes resources among various actors and uses according to certain rules and mechanisms, enabling limited resources to create maximum benefits. Effective S&T resource allocation ensures the realization of S&T strategic objectives and major priorities, optimizes the investment proportion among basic research, applied technology research, and product development, and maximizes resource use efficiency. (3) Policy on S&T talent encompasses laws, measures, methods, and regulations concerning the cultivation, use, introduction, mobility, evaluation, motivation, and management of S&T talent to build a talent force serving national S&T strategy. Scientists and engineers are the main force in knowledge production and technological innovation, serving as carriers of knowledge and technology. S&T talent policy can promote the transfer and transformation of technology and better utilize S&T innovation achievements through independent cultivation or overseas introduction of S&T innovation talent. (4) Policy on achievement transformation comprises various direct and indirect means, regulations, and measures to promote achievement transformation and regulate the transformation process and actor behavior. (5) Policy on environment cultivation involves the government building a fair, equal, benignly competitive, freely creative, and responsibly innovative environment with stability and predictability through legal regulations, review and approval, intellectual property protection, research integrity, and ethics policies.

2.2 Analysis of Value Orientation

S&T innovation strategies and policies demonstrate multiple value connotations with political, S&T progress, economic, social development, and ecological civilization value orientations, exerting strong value guidance [5]. (1) Political value is reflected in promoting high-level S&T self-reliance and building a world S&T power as national and ethnic progress value orientations. (2) S&T progress value is the most direct value manifestation of S&T innovation strategies and policies, integrating innovation resources, grasping innovation direction, and

enhancing the country' s S&T innovation level and independent innovation capability in strategic S&T fields. (3) Economic value is the fundamental value of S&T innovation strategies and policies, promoting S&T achievement transfer and transformation, enhancing national industrial competitiveness, and thereby generating new economic utility through S&T innovation. (4) Social development value mainly refers to S&T innovation strategies and policies' ability to cultivate an innovation culture, foster a favorable innovation ecosystem, enhance public scientific literacy, promote public understanding of science, and make science an important culture driving social civilization progress. (5) Ecological civilization value focuses on the green-friendliness of S&T innovation strategies and policies, emphasizing their role in promoting green, low-carbon, and sustainable development [5].

In the "3+5" framework, the guiding strategy, planning layout, and institutional arrangement of the "design layer" demonstrate characteristics of multiple value integration. On the one hand, the "design layer" takes the overall national development objectives as primary considerations, exhibiting political value orientation. On the other hand, the S&T innovation strategy-policy system needs to adapt to the national overall layout of high-quality economic development, social construction, and ecological civilization construction, making economic, social development, and ecological civilization values manifest in guiding strategy, planning layout, and institutional arrangement.

The "construction layer" focuses more on S&T progress value and economic value within the "S&T progress—economic growth" chain. As a key driver of economic growth, S&T innovation activities differ from general production input factors, characterized by coexistence of high risk and high return, systematic and complex nature, disruptiveness, and uncertainty [8]. This requires effective roles of both a capable government and an efficient market to allocate innovation resources effectively. Consequently, the "construction layer" leverages government leadership through laws, regulations, strategic plans, and policy tools to support S&T innovation activities and basic capacity building with long cycles, high risks, and high difficulty, consolidating innovation foundations, cultivating innovation forces, and stimulating innovation vitality. Simultaneously, it requires the market to play a fundamental role in guiding effective allocation, flow, and agglomeration of innovation resources through demand, promoting industry-university-research cooperation and enterprise technological innovation. Overall, the effective functioning of both government and market can achieve S&T progress and economic value.

3. Practical Analysis of China' s S&T Innovation Strategy and Policy Top-Level Design Based on the "3+5"Framework

The Party and the state have proposed a series of guiding strategies for S&T innovation work, formulated and implemented a series of national medium- and long-term S&T plans, and reformed and innovated supporting institutional arrangements during different historical periods. This section conducts a retro-

spective analysis of China' s S&T innovation strategy and policy "design layer" practices according to the "3+5" framework to understand the top-level architecture and evolution of China' s S&T innovation strategy and policy.

3.1 Guiding Strategy

S&T guiding strategy represents the overall and global program for S&T development during a certain historical period, with distinct epochal and target characteristics, providing the most concentrated and macroscopic guidance for S&T development goals and directions.

In the early period of the People' s Republic of China, against the backdrop of national reconstruction across all sectors and extremely weak S&T foundations with severe talent shortages, the goal of S&T undertakings was to build a strong national defense industry and escape poverty and backwardness. The central government thus proposed "marching toward science."In 1956, closely integrated with national construction needs, the principle of "focused development, catching up" was established. This series of guiding strategies laid the foundation, broke blockades, and established the system for China' s S&T undertakings.

Since the reform and opening up, at the 1978 National Science Conference, Comrade Deng Xiaoping made the important judgment that "science and technology are productive forces." In 1985, the *Decision of the Central Committee of the Communist Party of China on the Reform of the Science and Technology System* established the strategic principle that "economic construction must rely on science and technology, and S&T work must face economic construction," emphasizing the integration of S&T and economy, which guided and promoted China' s S&T undertakings to reform, open up, and catch up comprehensively.

Entering the new century, against the backdrop of accelerated economic globalization, the arrival of the knowledge economy era, and increased economic uncertainty, advanced S&T undertakings would help China occupy an active position in the international competitive environment. The central government thoroughly implemented the Strategy for Revitalizing the Country through Science and Education, achieving substantial improvement in industrial technology levels and international competitiveness. In 2006, the state established the "16-character principle" of "independent innovation, key breakthroughs, supporting development, and leading the future," which guided and promoted China' s independent innovation and key breakthroughs.

Entering the new era, S&T innovation has become the main battlefield of great-power games, with increasingly fierce competition for S&T commanding heights. China has entered a high-quality development stage, with S&T innovation occupying a core position in the national development overall situation. The 18th Party Congress proposed implementing the Innovation-Driven Development Strategy. In 2015, the *Opinions of the Central Committee of the Communist Party of China and the State Council on Deepening System and Mechanism Reform to Accelerate the Implementation of the Innovation-Driven De-*

velopment Strategy emphasized the market' s decisive role in resource allocation and the better functioning of the government. The Fifth Plenary Session of the 18th Central Committee proposed that "innovation is the primary driver of development." In 2016, the *National Innovation-Driven Development Strategy Outline* proposed the "three-step" strategic goal of building a world S&T innovation power, emphasizing dual-wheel drive of S&T innovation and institutional mechanism innovation. In 2020, the Fifth Plenary Session of the 19th Central Committee proposed "adhering to the core position of innovation in China' s modernization construction and taking S&T self-reliance as the strategic support for national development." In 2020, at the scientists' symposium, General Secretary Xi Jinping proposed adhering to the "four orientations" : facing the frontiers of world S&T, facing the main battlefield of the economy, facing major national needs, and facing people' s life and health, clarifying the direction of S&T development. In 2021, at the 20th Academician Conference of the Chinese Academy of Sciences, the 15th Academician Conference of the Chinese Academy of Engineering, and the 10th National Congress of the China Association for Science and Technology, General Secretary Xi Jinping proposed "achieving high-level S&T self-reliance," further improving China' s S&T innovation guiding strategy. In March 2023, the *Plan for the Reform of Party and State Institutions* stated that "the Party Central Committee' s centralized and unified leadership over S&T work is the fundamental political guarantee for building a world S&T power." In July 2023, during his inspection in Jiangsu, General Secretary Xi Jinping emphasized that the key to Chinese modernization lies in S&T modernization. During this period, China has accelerated building a world S&T power, promoting S&T development from independent innovation to independent controllability, to self-reliance, and then to high-level self-reliance.

It is evident that with different historical backgrounds and national needs, the positioning of S&T in national guiding strategies has evolved from productive force to driving force and then to the core position of overall development. S&T development has always been an important tool and strong support for meeting national needs and achieving social progress, becoming a foundational and strategic support.

3.2 Planning Layout

S&T planning layout, under the guidance of S&T development guiding strategy and based on understanding of S&T innovation laws, makes unified arrangements for S&T development in phases.

In the early period of the People' s Republic of China, focusing on the basic requirements for science and technology posed by national economic and defense construction, the *1956–1967 Long-Range Plan for the Development of Science and Technology* was issued, determining 57 major tasks across 13 aspects.

Since the reform and opening up, guided by the principle of integrating economic development with S&T innovation, the *1986–2000 National Science and*

Technology Development Plan was issued, emphasizing S&T innovation serving economic construction and promoting rapid application of S&T achievements.

Entering the new century, the *National Medium- and Long-Term Program for Science and Technology Development (2006–2020)* was issued, planning 11 key areas, 62 priority themes, 16 major projects, frontier technologies in 8 aspects, and basic research issues in 4 aspects, clarifying key breakthrough areas and fields with significant impact.

Entering the new era, based on the understanding that "innovation is the primary driver of development" and the goal of achieving "high-level S&T self-reliance," and facing the main battlefield of S&T innovation in great-power games, the central government released the *14th Five-Year National S&T Innovation Plan* and the *National Medium- and Long-Term Program for Science and Technology Development (2021–2035)* and other top-level design documents, planning and deploying key tasks such as strengthening national strategic S&T forces, coordinating basic and applied research deployments, and fighting key core technology battles.

Thus, China' s medium- and long-term S&T plans in different historical periods have distinct epochal characteristics. Within a certain time frame, these plans transform national guiding strategy into action programs with goals, layouts, tasks, policies, and guarantees. Planning layout makes global, guiding, and programmatic arrangements for S&T activities, based on which China formulates supporting plans and implementation rules, forming a planning system composed of long-term, medium-term, and short-term S&T plans, with overall plans and special plans connecting with each other.

3.3 Institutional Arrangement

Under the guidance of S&T guiding strategy and planning layout, institutional arrangements establish the institutions, organizational systems, and legal norms for S&T activities. Scientific institutional arrangements can effectively improve S&T resource allocation efficiency, clarify the responsibilities and positioning of different innovative actors, strengthen strategic S&T forces, cultivate and introduce high-level S&T talent, open up the transmission channel for S&T innovation driving high-quality economic and social development from basic research to technology development to industrial application, thereby rationalizing the rules and procedures of S&T innovation activities and facilitating the implementation of S&T innovation guiding strategy and the advancement of S&T planning layout.

In the early period of the People's Republic of China, China established a highly centralized S&T system and organizational model [9], concentrating research activities in various research institutions and forming five S&T forces: the Chinese Academy of Sciences, universities, industrial research institutes, defense research institutes, and local research institutions.

Since the reform and opening up, large amounts of international advanced technologies and experiences have been introduced, absorbed, and re-innovated, with more and more S&T resources, especially technological resources, concentrating in enterprises. However, Chinese S&T enterprises during this stage mainly occupied low value-added segments of global value chains and production networks, with weak foundations in original basic research and key core technologies, and the state lacked overall coordination of macro-management functions for S&T.

Entering the new century, with the establishment and development of the socialist market economy system, China conducted a series of major reforms in macro-management regarding the division of labor between government and market, among central government departments in S&T management functions, and between central and local governments in S&T authority, making a series of new institutional arrangements. In September 2012, the *Opinions on Deepening the Reform of the S&T System and Accelerating the Construction of the National Innovation System* proposed the major understanding that reform of the S&T system is a systematic project requiring the formation of a new mechanism for coordinated advancement, establishing the National S&T System Reform and Innovation System Construction Leading Group to improve and perfect the national S&T macro decision-making system.

Entering the new era, strengthening overall coordination of national macro-management functions for S&T and deepening S&T system reform have become trends [10, 11]. The reform of the S&T macro-management system has accelerated and continued to deepen, providing institutional guarantees for implementing S&T strategic planning in the new era. In 2018, the *Plan for Deepening the Reform of Party and State Institutions* proposed reorganizing the Ministry of Science and Technology, clarifying its main responsibilities including coordinating the construction of the national innovation system and S&T system reform, formulating and organizing the implementation of S&T development plans, managing major national S&T projects, and being responsible for introducing foreign S&T talent. The National Natural Science Foundation of China was placed under the management of the Ministry of Science and Technology. The National S&T Advisory Committee was established to implement consultation on major national S&T decisions.

In 2021, the *Outline of the 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives Through 2035* proposed improving the new national system under socialist market economy conditions. At the 20th Academician Conference of the Chinese Academy of Sciences, the 15th Academician Conference of the Chinese Academy of Engineering, and the 10th National Congress of the China Association for Science and Technology, General Secretary Xi Jinping proposed forming basic systems supporting comprehensive innovation. The *Three-Year Action Plan for S&T System Reform (2021-2023)* proposed leveraging the role of the Party and the state as leaders and organizers of major S&T innovation, and building an efficient organizational system for tackling key core technologies. In 2022, the 20th Party Congress report

proposed "strengthening strategic S&T consultation" to better serve top-level planning and strategic layout.

In 2023, facing new tasks proposed by the new era and new journey, to comprehensively build Chinese modernization, Party and state institutional settings and functional configurations were further adjusted. The *Plan for the Reform of Party and State Institutions* proposed establishing the Central S&T Commission, whose main responsibilities include coordinating the construction of the national innovation system and S&T system reform, reviewing major S&T strategies, plans, and policies, determining strategic S&T tasks and major projects, and coordinating strategic S&T forces such as national laboratories. The establishment of the Central S&T Commission further strengthened the state' s overall coordination and management functions for S&T. The reform plan proposed reorganizing the Ministry of Science and Technology, with the Central S&T Commission' s office functions undertaken by the reorganized Ministry of Science and Technology as a whole. Consequently, the Ministry of Science and Technology' s functions transformed to managing macro issues, planning, and policies, no longer managing specific projects. The Central S&T Commission' s establishment strengthened the Party Central Committee' s centralized and unified leadership over S&T work, improved the new national system, deepened S&T system reform, and formed basic systems supporting comprehensive innovation.

In summary, around the implementation of guiding strategies and planning layouts in different historical periods, China has correspondingly reformed and adjusted its management system, organizational system, and operational mechanisms, making new institutional arrangements to enable S&T production relations to better adapt to the development requirements of S&T productive forces and ensure the effective realization of various goals and tasks.

4. Conclusion

Building a world S&T power requires S&T strategic planning guidance and continuous S&T policy innovation.

(1) **Design Layer.** We must adhere to the principle that S&T is the primary productive force, talent is the primary resource, and innovation is the primary driver; thoroughly implement the Strategy for Revitalizing the Country through Science and Education, the Strategy for Strengthening the Country through Talent, and the Innovation-Driven Development Strategy; adhere to the "four orientations" ; take national strategic needs as the guide; gather strength to conduct original and leading S&T research; and resolutely win the battle for key core technologies. We must strengthen basic research, emphasize originality, and encourage free exploration; improve the new national system under socialist market economy conditions; and strengthen the Party Central Committee' s centralized and unified leadership over S&T work, improve the new national system,

deepen S&T system reform, and form basic systems supporting comprehensive innovation.

(2) **Construction Layer.** We must strengthen national strategic S&T forces, optimize the positioning and layout of national research institutions, high-level research universities, and S&T-leading enterprises, form a national laboratory system, strengthen enterprises' position as the main actors in S&T innovation, coordinate the construction of international and regional S&T innovation centers, and enhance the overall effectiveness of the national innovation system. We must optimize the allocation of innovation resources, improve S&T investment efficiency, increase diversified S&T investment, and implement a batch of national major S&T projects with strategic, global, and forward-looking significance. We must accelerate the construction of world-important talent centers and innovation highlands, accelerate building national strategic talent forces, focus on forming comparative advantages in international talent competition; strengthen intellectual property legal protection, strengthen enterprise-led deep integration of industry-university-research, improve the level of achievement transformation and industrialization, and promote deep integration of innovation chains, industrial chains, capital chains, and talent chains. We must cultivate an innovation culture, promote the spirit of scientists, foster excellent academic integrity, and create an innovative atmosphere. We must strengthen the construction of an internationalized research environment and form an open innovation ecosystem with global competitiveness.

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