

Research on the Science and Technology Management System and Mechanism from a Global Perspective

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Abstract. As technology plays an increasingly crucial role in global economic and social development, countries around the world are actively building and improving their own science and technology management systems and mechanisms to enhance their scientific and technological innovation capabilities and competitiveness. Through an in-depth study of the science and technology management systems and mechanisms of typical countries and regions globally, this paper analyzes their characteristics and models in policy-making, resource allocation, and result transformation, summarizes successful experiences and challenges faced, aiming to provide valuable references and insights for the optimization and innovation of the global science and technology management systems and mechanisms. It helps countries break through development bottlenecks in the field of science and technology, promotes the efficient flow and rational allocation of scientific and technological resources on a global scale, and propels the science and technology management systems and mechanisms to a new height of development.

Keywords: Science and Technology Management; Systems and Mechanisms.

1. Research Background and Significance

In this era of rapid change, technology has become a key force driving social progress and economic development. From artificial intelligence to biotechnology, from renewable energy to information technology, technological innovation continuously expands the boundaries of human cognition, reshapes industrial landscapes, and leads the global economy towards greater efficiency, intelligence, and sustainability. However, the rapid development of technology is also accompanied by increased complexity and uncertainty. How to manage technological activities and maximize their positive impacts effectively has become an urgent and important issue to be addressed. As the core engine in this process, the significance of technology management is increasingly prominent.

In the context of globalization today, the scientificity and effectiveness of the technology management system and mechanism directly affect a country or region's technological development level and innovation capacity. Different countries and regions have formed their own distinctive technology management systems and mechanisms based on their unique historical, cultural, political, and economic backgrounds. In-depth research on global technology management systems and mechanisms can help fully absorb international advanced experiences, optimize their own technology management systems, and promote the in-depth implementation of the innovation-driven development strategy.

2. Theoretical Foundations of Global Science and Technology Management Systems and Mechanisms

2.1 The Connotation of Science and Technology Management and Its Relationship with Government Organizations

The science and technology management system refers to the management form, method and system implemented by the state in organizational leadership and management of science and technology affairs. It stipulates the organizational structure and operation mode of the entire national science and technology system, and reflects the mutual connection and interest relationship between

the state, collective and individual. The science and technology management system is divided into scientific research organization and scientific research management system, including science and technology system, science and technology policies and regulations, science and technology development strategies, science and technology resource allocation, science and technology project management, science and technology achievement management, science and technology talent management, science and technology cooperation and exchanges, etc. [1].

There is a close connection between the government organizational structure and the science and technology management system. They influence each other and work together to play a key role in the process of national scientific and technological innovation and development. In the innovation system of a country, the government is in a critical position due to the various legal powers granted by law. The establishment of government organizations and departments is closely related to the national science and technology system, and departmental changes can even lead to the reform of the science and technology system. Although there is a certain degree of convergence in the establishment of government institutions in modern countries, there is no fixed and unchanging model for science and technology management organizations. The science and technology systems of various countries around the world adopt different ways of setting up institutions, and they are constantly adjusted according to the needs of the development of productive forces [2].

2.2 Classification and Characteristics of Global Science and Technology Management Institutional Mechanisms

The global science and technology management institutional mechanisms are diverse. According to the degree of centralization of government power in science and technology management and the coordination methods, they can be roughly divided into three models: the centralized model, the decentralized model, and the intermediate model. Each model has its unique characteristics and has typical practices in different countries.

The main feature of centralized science and technology management system is that the government occupies a dominant position in science and technology management, its power is relatively concentrated, and it carries out comprehensive and systematic planning and regulation of science and technology development. Through the formulation of a unified science and technology policy and the establishment of a special science and technology management organization, the government centrally manages the allocation of science and technology resources and the establishment and implementation of scientific research projects. The advantage of this model is that it can effectively integrate national science and technology resources, concentrate efforts to carry out major science and technology projects, and achieve the national science and technology strategic goals. The government can give priority to investing scientific and technological resources in key areas and research and development of key technologies in accordance with the strategic needs of national development, to avoid the dispersion and duplication of resources, and improve the utilization efficiency of scientific and technological resources. However, the centralized model also has certain limitations. Due to the high concentration of decision-making power, there may be a lack of sufficient market research and extensive social participation in the decision-making process, which makes the science and technology policy out of touch with the market demand and the actual social situation. Under this model, scientific research institutions and researchers may have a high degree of dependence on the government and lack of innovation autonomy and enthusiasm, which is not conducive to diversified innovation and development in the field of science and technology.

The characteristics of the decentralized science and technology management system and mechanism are that the government's power in science and technology management is relatively dispersed, there is no highly centralized science and technology management organization, and science and technology management functions are jointly undertaken by multiple departments or institutions. Under this model, the government mainly guides and promotes the development of science and technology through the formulation of science and technology policies and the provision of financial support, while the specific management of scientific research projects and the allocation

of scientific and technological resources are independently responsible by various departments, research institutions and enterprises. The advantage of the decentralized system is that it can give full play to the enthusiasm and initiative of various departments, research institutions and enterprises to promote the diversified development of science and technology. Different departments and institutions can carry out research activities with their own characteristics and advantages, and form an innovative situation in which a hundred flowers bloom. However, the decentralized mode also has some problems. Due to the decentralized power of science and technology management, the coordination and consistency of science and technology policies may be insufficient, and there is a lack of effective communication and collaboration among various departments, which is prone to repeated allocation and waste of science and technology resources. The development of science and technology under this model may lack overall planning and strategic layout, and it is difficult to focus on overcoming major scientific and technological problems.

The management system and mechanism of medium-scale science and technology integrate the characteristics of centralization and decentralization, emphasizing not only the macro-control role of the government in science and technology management, but also the enthusiasm and initiative of various departments, research institutions and enterprises. The government guides the direction of science and technology development by formulating science and technology policies and planning science and technology development strategies. At the same time, it establishes science and technology coordination institutions to strengthen communication and cooperation among various departments and optimize the allocation of science and technology resources. Under this model, all departments, research institutions and enterprises have a certain degree of independent decision-making power and can carry out scientific research activities according to their own actual conditions under the premise of following the national science and technology policies and strategies. The advantage of the system and mechanism is that it can not only give play to the macro-control role of the government, ensure the integrity and coordination of scientific and technological development, but also fully mobilize the enthusiasm and initiative of all parties to promote diversified innovation and development in the field of science and technology. It can better balance the relationship between government and market, concentration and decentralization, and improve the efficiency and effect of science and technology management.

3. Analysis of the Science and Technology Management Institutional Mechanisms of Typical Countries

3.1 South Korea: Centralized System

In terms of management mode, the science and technology management system of South Korea shows a remarkable feature of high concentration. The government plays a leading role in the development of science and technology by formulating comprehensive and systematic science and technology policies to conduct macro-planning and regulation of science and technology development. From the formulation of science and technology policies to the establishment, approval, implementation and supervision of science and technology projects, to the allocation of science and technology resources, the government has a large decision-making power. By formulating long-term science and technology development plans, the South Korean government defines the key areas and directions of science and technology development, concentrates scientific and technological resources into key technology research and development and key industrial fields, and ensures the realization of national science and technology strategic goals. In the early stage of the development of the semiconductor industry, the government formulated relevant policies and concentrated resources to support the R&D investment of Samsung, LG and other companies, so that South Korea achieved a breakthrough in semiconductor technology and the rise of the industry in a short period of time.

3.2 The United States: Decentralized System

The US government has not set up a special department of science and technology, and science and technology management functions are scattered in many departments, such as the Department of Defense, the Department of Energy, and the National Science Foundation. According to their own tasks and objectives, each department formulates corresponding science and technology policies and plans to carry out scientific research projects. The Ministry of National Defense plays an important role in military science and technology research and development, and invests a lot of funds to support military technology innovation. The Department of Energy focuses on scientific and technological research and development in the field of energy to promote the development of new energy technologies. American enterprises, universities and research institutions also have a high degree of autonomy in scientific and technological innovation, and they carry out various scientific and technological activities according to market demand and their own development strategies, forming a diversified pattern of scientific and technological innovation.

3.3 China: Exploration of a System Suited to the National Conditions

China attaches importance to the dual role of the government and the market [3]. The government regulates and guides the development of science and technology through the formulation of science and technology policies, the planning of science and technology development strategies, and the investment of scientific research funds. The government has increased investment in basic research and research in cutting-edge technologies, supported the development of major scientific and technological projects, and promoted the improvement of national scientific and technological strength. The government also encourages enterprises to increase investment in scientific and technological research and development through tax incentives, subsidies and other policy measures to promote the transformation and application of scientific and technological achievements. The market also plays an important role in the allocation of scientific and technological resources. Through the market mechanism, scientific and technological resources are guided to flow to enterprises and scientific research institutions with good efficiency and strong innovation ability. Market competition encourages enterprises to continuously increase R&D investment, improve technical level and product quality, and promote scientific and technological progress. Market demand also guides the research and development direction of scientific research institutions and enterprises, making science and technology research and development closer to the actual needs, and improving the application value of scientific and technological achievements.

4. Development Trends of the Global Science and Technology Management Institutional Mechanisms

4.1 Institutionalization of Science and Technology Decision-making Consultation

In the increasingly fierce global scientific and technological competition, the establishment of a normal decision-making consultation mechanism has become an international consensus, and its importance is increasingly prominent. As a key bridge connecting science and technology and decision-making, science and technology decision-making consultation can provide professional and scientific suggestions for decision-making bodies such as governments and enterprises, so as to ensure scientific, forward-looking and accurate decision-making. With the rapid development of science and technology, the cross-fusion characteristics of frontier technologies are becoming more and more significant, and new knowledge, new technology and new applications are increasing exponentially. In this situation, the formulation and decision-making process of science and technology innovation strategy and policy has become increasingly complex, and decision-making departments not only need to accurately insight into the development trend of domestic industry, but also need to comprehensively consider the multidimensional pattern of international science and technology competition and cooperation.

4.2 Systematization of Science and Technology Innovation Policies

As a strong support for the formation and development of new quality productivity, science and technology innovation policies can play a guiding, supporting, promoting and coordinating role in the formation of new quality productivity by optimizing the allocation of innovation resources, guiding and regulating market behaviors, and creating an open innovation ecology. Therefore, the construction of a science and technology innovation policy system needs to keep up with the pace of The Times, grasp the general trend, and forward-looking planning, and comprehensively cover multiple dimensions such as science and technology innovation strategy and planning, innovation main body cultivation, innovation factor allocation, industrial innovation development, regional innovation layout, innovation environment optimization, and open innovation ecology, so as to provide all-round support for scientific and technological innovation to match industrial innovation.

4.3 Synergy of Scientific Research Organization and Achievement Transformation

The remarkable feature of the new quality productivity lies in the two-wheel drive mode of "science and technology + industry", in which the core of the transformation of scientific and technological achievements is to realize the accurate docking of science and technology supply and market demand. The organized promotion of the "scientific research + results transformation" model can significantly strengthen the effective supply capacity of scientific and technological innovation, and foster more all-round leaps from basic research breakthroughs to applied technological innovation to industrial development. Through the catalysis of "new" scientific and technological innovation, to achieve the "quality" of industrial development, and then to deepen the "quality" of industry, to promote the "new" breakthrough of scientific and technological innovation, to form a virtuous circle of demand traction supply, supply to create demand, and to cast new advantages and new engines for national development. Under the current international background of science and technology blockade and technology decoupling, the transformation of scientific and technological achievements has become a key link to achieve scientific and technological self-reliance [4].

5. Conclusion

This study comprehensively and deeply analyzes the global science and technology management system and mechanisms, revealing its importance and complexity in the current era. The global science and technology management system and mechanism show a diversified pattern, different countries according to their own national conditions, historical and cultural background and scientific and technological development needs, formed their own unique system and mechanism model. The decentralized system of the United States, with its diversified decision-making bodies, market-led resource allocation and perfect innovation incentive mechanism, has stimulated the innovation vitality in the field of science and technology and promoted the rapid development of the science and technology industry. South Korea's centralized system, through the leading role of the government, perfect legal and regulatory protection and efficient allocation of resources, in a short period of time to realize the leapfrog development of science and technology, especially in the semiconductor and other key industries have made remarkable achievements. China, on the basis of adapting to its national conditions, has continuously explored and reformed, formed a diversified and coordinated management structure, paid attention to the dual role of the government and the market, and is committed to improving science and technology project management, achievement evaluation and talent incentive mechanisms.

Many valuable experiences can be summarized from the science and technology management system and mechanism of these typical countries. In the formulation of science and technology policy, it should be forward-looking and sustainable, take full account of the trend of science and technology development and national strategic needs, and provide clear direction for science and technology development. Resource integration is crucial, the establishment of cross-departmental and cross-field science and technology resource sharing platform, promote the efficient flow and sharing of science

and technology resources, can improve the utilization efficiency of science and technology resources. Scientific and technological talents are the core force of scientific and technological innovation. Strengthening the construction of the system for training scientific and technological talents, deepening the reform of education, focusing on cultivating students' innovative thinking and practical ability, improving the policy of introducing talents, optimizing the environment for the development of talents, and attracting outstanding scientific and technological talents from around the world are the keys to enhancing the national scientific and technological competitiveness.

References

- [1] Shen Jiawen. Strategic Thoughts on Deepening the Reform of the Science and Technology Management System in the New Development Stage. *China Economic & Trade Herald*, 2022, 10: 64-67.
- [2] Sui Jigang. Reform of Science and Technology Institutions and the Construction of the New National System. *People's Tribune*, 2023, 9: 64-67.
- [3] Su Jicheng, Li Hongjuan. Research on the Ideas and Countermeasures for Deepening the Reform of the Science and Technology System in the New Development Pattern. *Macroeconomic Research*, 2021, 7: 100-111.
- [4] Cao Shaojie. "Analysis of the Effective Approaches to Constructing the Science and Technology Management System. *Enterprise Reform and Management*, 2025, 4: 35-36.