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Guarantee System of Science and Technology Innovation Policy in the Comprehensive National Science Center: Evidence from China

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Abstract
Aiming to gain competitive advantages in the international scientific and technological innovation, Chinese government initiated to build comprehensive national science center (CNSC) since 2016. Science and technology innovation policy is playing a significant and irreplaceable role in the construction and development of CNSC. From the perspective of public policy, the current study analyzed the policies of CNSC at both national and ministerial level, judged its characteristics and strategic functions, and provided practical suggestions. The comprehensive analyses indicated that these policies can effectively guarantee the system of CNSC with regarding to the talent development, science and technology financial development, intellectual property protection, and transformation of scientific and technological achievements.
Keywords: CNSC, Policy analysis, Science and technology innovation policy

1. Introduction

Nowadays, disruptive technologies are constantly emerging to fundamentally address a series of major scientific problems, which significantly changes the national power in global development. Facing with these opportunities and challenges, a majority of countries are strengthening their innovation strategies through launching public policies, which aims to enhance the supporting force of innovation in the national strategies. For example, the United States issued a national innovation strategy successively in 2009, 2011 and 2015, the United Kingdom issued the innovation and research strategy for growth in 2011, South Korea issued the creative economy implementation plan in 2013, and the Japanese cabinet released the comprehensive strategy for science and technology innovation in 2017. Consistently, the Chinese government issued the outline of the national innovation-driven development strategy in 2016, proposing to build the world's scientific and technological innovation power by 2050 and realize the transition from "big country" to "strong country". However, as Pan (2017) claimed, China's capability of independent innovation, especially the original innovation ability, is comparatively weak, and the situations that the core technology is lacking is still a serious problem. Thus, the comprehensive innovation capacity in China is still far behind the scientific and technological powerful countries (e.g., United States and Germany).

Based on the processes of development in the most awe-inspiring countries in science and technology, the constructions of science and technology institutions supported by governments are becoming the key drivers in leading and promoting the area of basic subject research. There are such successful examples as the Royal Society (RS) in UK, the National Cavendish Laboratory in UK, the National Center for Scientific Research (CNRS) in France, the Max Planck Institute (MPG) in Germany, the Helmholtz Association (HGF) in Germany, seventeen National Laboratories supported by the Department of Energy in US. Therefore, since 2016, the Chinese government has laid out plans to build national comprehensive science centers (CNSC) including Zhangjiang in Shanghai, Hefei in Anhui, Huairou in Beijing, etc., to accelerate the innovative cultivation in the national strategic frontier areas of science and technology and facilitate the national innovative development.

Given the significance above, CNSC and its related policies have attracted scholars' attention in various research areas. Specifically, Wang (2016) is the first to define the concept of CNSC as a large and open R&D base established with the approval of national legal procedures. From the perspective of characteristic, Qian (2017) suggests that CNSC is an ecological community of scientific research which is based on the large scientific installations or facilities, and large scientific research teams to assemble the world-class innovative universities, research institutions and researcher. Another line of literature from the research on the public policies reported the suggestions on the construction of CNSC. Specifically, Zhang (2017) claimed that CNSC

should be supported primarily by national policies in the early stage, and transformed into a development model dominated by market forces in the later stage. Zhang (2018) suggested that scientists should be encouraged to launch a series of large-scale science and technology action plans in order to deeply participate in international scientific and technological cooperation and competition. Wang (2017) suggested that improving the mechanisms of intellectual property protection should be emphasized. Chen (2018) provided policy suggestions on the talent protection in CNSC, including overall talent planning and hiring high-end talents. Zhang and Zhao (2018) proposed to ensure the continuous development of basic research with stable and continuous investment policies.

To sum up, as an emerging phenomenon, the research on CNSC is still in its infancy, and the related policy research is not investigated in-depth and comprehensively. Specifically, although most scholars discuss on building CNSC, they overlook the policy that guarantees the operational processes in the later stage. Moreover, most policy suggestions provided by scholars are from a single aspect, which fails to comprehensively paint a picture of CNSC from a systematic perspective. Furthermore, examinations thus far are conducted without considering the national overall planning. Finally, scholars primarily proposed the direction of policy optimization, which lacks the concrete policy construction strategies.

The present study aims to fill in the research gaps above. Specifically, given that CNSC is a government-led project, public policy definitely plays an irreplaceable role in the processes of constructions and developments. Therefore, from the perspective of public policy, the present study analyze the existing science and technology policy provisions of CNSC, judge its policy orientation, and analyze the strategic function positioning of CNSC based on this, and then propose some Suggestions for constructing the policy guarantee system based on the operational needs of CNSC.

2. Overview of Scientific and Technological Innovation Policies

The development of innovation research originated from Schumpeter's (1912) work in the early 20th century. With the development of innovation models (e.g., linear model, link interaction model, and vendor-centric model), research in the innovation system develops rapidly, including multiple perspective (e.g., the regional innovation system research stream, and the industrial innovation system research stream). Generally, existing research results can be summarized in the following three aspects.

2.1 Connotation of Science and Technology Innovation Policy

Anderson (1979) proposed that public policy is a purposeful behavior process formulated by government agencies or government officials in order to deal with problems. As an important aspect in the public policies, the science and technology innovation policy occupies an increasingly important position in the public system. Rothwell (1986) defined the technology policy as an integration of series of public policies including intellectual property protection, career education, basic theory research, and application research. In Lundvall's (2005) study, through comparisons, he found that science policy focused on innovation and diffusion of scientific knowledge, technology policy focused on technology innovation and its transformation, while innovation policy focused on the ability of overall innovation. Tang (1988) defined the technology innovation policy as all the direct and indirect measures implemented by the government towards developing industrial technology innovation. Lian (1998) argued that technology policy is the sum of various direct and indirect policies adopted by the state to promote technological innovation. Van Bernet et al. (2012) proposed that technology policy is the core of innovation policy.

2.2 Classification of Science and Technology Innovation Policies

According to the differences of policy orientations, Ergas (1987) divided technology policies into mission-oriented and diffusion-oriented policies. Specifically, he reported that the technology policies in United Kingdom, France, and United States are mission-oriented, while in Switzerland, Sweden, and Germany are diffusion-oriented. From the perspective of policy evolution, Cantner and Pyka (2001) classified science and technology innovation policies into four types—i.e., diffusion, mission, basic research I, and basic research II. Freitas and Tunzelmann (2008) suggested that science and technology innovation policies can be categorized into three dimensions—i.e., policy objectives (diffusion, mission or horizontal), tool selection (general or specific), and policy subjects (local or central). From the perspective of policy supply, Tang (1988) characterized the science and technology policy tools into multiple aspects including education training, subsidies, loans, grants, transfers, scientific research facilities, etc.. Zhong et al. (2009) classified the science and technology innovation policies in China into administrative, personnel, fiscal, financial and other measures.

2.3 Evolution of Science and Technology Innovation Policies

From the perspective of policy development, Kuhlmann (2001) highlighted the prospect of related policy governance after reviewing the evolutional process of science and technology innovation policies in European

Union. Mustar et al. (2002) from the evolution of French innovation research policy from the perspective of criticism suggested that the traditional Colbertist Model failed to be applied in the realistic situation in France. Radosevic (2003) proposed that the key of science and technology policy is to adjust and reconstruct science and technology system. He also suggested to divide the evolution process of science and technology policy into protection, reconstruction and survival stages. Wu et al. (1998) divided the technological innovation policies after the China's reform and opening policies into three stages: the 1980s and before, the 1990s before 1995, 1995 and after. He also systematically summarized the characteristics of these policies at each stage. Chen and Wang (2005) investigated the evolution of policy instruments such as government funding from 1978 to 2000. Liu and Sun (2007) proposed the evolution trend of China's science and technology innovation policies from two aspects—i.e., from one-way promotion to coordinated promotion, and from single policy to policy combination. Huang (2018) found that more scholars began to pay attention to "the role of science and technology innovation policies in building regional innovation networks" and "analysis of influencing factors of regional innovation policies and their structural defects".

To sum up, although the concept and scope of science and technology innovation policies are still unclear in the current research, scholars have some consensus. First, rather than an independent policy, science and technology innovation policy is a policy system built around technological innovation, which it is integrated with public policies such as industry and economy. Second, despite differences, science policies, technology policies, and innovation policies are closely related to each other, all of which can be regarded as science and technology innovation policies. Moreover, science and technology innovation policy should be regarded as a policy system involving multiple policy areas. Finally, coordination among various policy areas has become an important research issue in science and technology innovation policy. Therefore, although there is no consensus on the classification of science and technology innovation policies has not formed a consensus, the diversity of policy instruments brings more avenues for policy choice.

3. Analysis of Relevant Policies of CNSC

3.1 National-Level Policies

Since China proposed a goal of building an innovative country, the focuses of policy involved original innovation, collaborative innovation, and open innovation. CNSC was proposed on the national level policy document for the first time on March 16, 2016. The Outline of the 13th Five-Year Plan for National Economic and Social Development requires to strengthen the ability of original innovation, integrated innovation, and introduction, digestion, absorption and innovation. Targeting on the frontier of international science and technology, based on the existing advanced facilities and other resource conditions, CNSC should be built to enhance the independent innovation capability. In July 2016, the State Council's 13th Five-Year National Science and Technology Innovation Plan further proposed to build a national comprehensive science center in Beijing, Shanghai, Anhui, etc., which formed a global competitiveness in the advantageous areas. So far, all three integrated national science centers have been appeared in national-level policy documents. Since then, in January 2018, the State Council launched a project—i.e., Several Opinions on Comprehensively Strengthening Basic Scientific Research—re-emphasized the constructions of CNSC in Shanghai Zhangjiang, Anhui Hefei, Beijing Huairou and other cities should be fully supported in order to create a original innovative highland. Furthermore, in March 2018, the state council issued the Active Leading Organization of International Big Science Plan and Big Science Project Plan, encouraged CNSC to not only actively participate in and organize big science plan, but also conduct high-level scientific research in the frontiers of world science and technology and key areas of the country.

CNSC related policies are generated under the overall layout of the national science and technology innovation policy system, which belongs to the national science and technology innovation policy system. Through reviewing these policies, it is clear that relevant policies at the national level emphasize five aspects. First, it emphasizes the establishment of CNSCs should rely on the construction and optimization of national major science and technology infrastructures. Second, positioned as a national basic research platform, CNSC has a core function to support both the basic and applied basic research to fulfill the national strategic needs. Third, CNSC is jointly built by the state and local governments, which not only meets the national innovation strategy requirements, but also fully consider the regional innovation conditions. This reflects that CNSCs should promote the continuous and coordinated development of national and regional innovation systems. Fourth, multi-class innovation entities should cooperate and participate in system construction of CNSCs. In addition to the large scientific installation groups, the construction of high-level national laboratories, first-class research universities and research institutes and other innovation platforms and innovation subjects should also be involved in order to generate both the agglomeration and synergistic effects of innovative resources. Finally, open innovation includes the open sharing of scientific and technological resources (e.g., large scientific devices inside and outside, and the in-depth exchange of talents), through integrating the global innovation network with large science programs.

3.2 Department-Level Policies

In March 2016, the National Development and Reform Commission and the Ministry of Science and Technology jointly approved the plan of CNSC construction in Shanghai Zhangjiang. This plan aims to build a world-class major technological facility, and develop the world's leading research groups and institutions. A series of actions effectively promote inter-disciplinary topics in the frontier science and technology innovation depth fusion, deepen the collaborative innovation, explore under the leadership of the council of independent management mechanism and decision-making mechanism. Scientists focus on energy, environment, life, material, material, and other areas of the frontier research to promote Zhangjiang CNSC as an important source of major original breakthroughs.

In January 2017, the National Development and Reform Commission and the Ministry of Science and Technology jointly approved the CNSC construction program in Hefei. Specifically, CNSC in Hefei relies on a big cluster of science device, which focuses on the four major fields (i.e., information, energy, health, and environment). Through integrating related resources, CNSC in Hefei aims to promote the overall innovation of science and technology innovation towards the construction of the international first-class level. Moreover, CNSC in Hefei involving interdisciplinary research targets on producing transformational technology, creating strategic emerging industries, becoming the foundation of the national innovation system platform.

Subsequently, in May 2017, the National Development and Reform Commission and the Ministry of Science and Technology jointly approved the CNSC construction program in in Beijing Huairou. Through absorbing the experience of the international famous science city, CNSC in Huairou aims to promote the development of major national science and technology infrastructure cluster. According to the international first-class standard of scientific platform layout, CNSC in Huairou build a world-class cluster including key state science and technology infrastructures. The future plan is to complete all the constructions and act as an international famous comprehensive science center.

In May 2017, the Chinese Academy of Sciences (CAS) issued a Guidance on Participating in the Construction of Science and Technology Innovation Centers and Building CNSC which indicates that more supports should be provided to facilitate the constructions of international science centers in Beijing, Shanghai, and Hefei. In particular, CAS enables the joint of national education resources and research strength to strengthen the interactions of universities and institutions in Beijing, Shanghai, and Hefei towards collaborative innovation. Moreover, according to the requirements of constructions of CNSCs, supporting policies would be provided to encourage and guide participants (e.g., universities) to join in CNSCs. More actions are also encouraged, such as constructions of joint research and development platform to transfer the scientific and technological achievements, and priority deployment of national key science and technology infrastructures.

Through comparing policies at the national level with those at the ministry level, policies at the ministry level are more specific and their contents are more clear, reflecting the top-down refinement process of policies. Moreover, the release time of policies at the level of ministries and commissions is basically synchronized or slightly delayed with policies at the national level. This shows that the coordination in the policy-making process between the state and relevant ministries and commissions is more consistent. Additionally, the policy support at the ministerial level is more targeted. In particular, the CAS specially formulates policies with clear guidance and strong operability, and the policy effect will be more remarkable. Finally, CNSC construction plans are similar in function positioning, but there are also many differences, which are embodied in differences in function positioning, innovation fields and collaborative layout.

3.3 Analysis of Characteristics of CNSC

CNSC is an initiative project in the process of the innovation system construction in China. Through comparative analyses of CNSC related policies such as Zhangjiang in Shanghai, Hefei in Anhui, and Huairou in Beijing, it is shown that although some differences among the three exist, there are more similarities among them. Therefore, the characteristics of CNSC can be summarized as follows:

- Targeting on creating a scientific research base that represents the highest level of the country and a world-class level, 2020 will be a preliminary milestone to showe the preliminary construction results.
- Taking the national mission as a construction goal, the orientation of constructions is to fulfill the national requirements towards sharing tasks of innovative country through combining the respective advantages and plans for innovation of each participant.
- The layout and construction of large scientific installations should be emphasized as a condition for CNSCs to carry out forward-looking and leading basic scientific research.
- All the actions should aim at the advantageous fields, concentrate on the cutting-edge forces, and strive to establish a national laboratory.
- The importance of integrating science and education should be both highlighted. In doing so, the strength of science and education can be developed to facilitate the laying out frontier science and education groups

- It is necessary to layout a number of cross cutting edge innovation platforms, especially reinforcing the interdisciplinary scientific research. In doing so, the major original breakthroughs can be achieved.
- Introduction, cultivation, and utilization of high-end talents are highly encouraged. That is, the core task is bringing cutting-edge talents together.
- Given the critical roles of collaborative innovation and open innovation which includes multi-subject linkage in basic research, applied basic research, applied research and other fields, the domestic and international competition and cooperation are encouraged and supported.
- It is urgent to promote the joint development of innovation chain and industrial chain. Through planning a number of industrial innovation and transformation platforms, and nurturing and incubating major industrialization projects and innovative scientific and technological enterprises, the driving role of scientific and technological innovation in industrial innovation and regional economic and social development could be realized.
- Innovation of operation management mechanism should be conducted, including the establishment of council and management organization, and exploration of new operation mechanism.

4. Strategic Functions of CNSC

According to Qian Xuesen's theory of open complex giant system, scientific and technological innovation includes three types—i.e., knowledge innovation guided by scientific research, technology innovation oriented by application innovation, and management innovation led by information technology (Song, 2009). Based on this perspective, through combining the analytical results of relevant policy documents and characteristics, the current proposes that main functions of CNSC should include knowledge innovation, technology innovation, innovation diffusion and management innovation.

4.1 Knowledge Innovation Oriented towards the World's Scientific Frontier

Challenge the most cutting-edge scientific issues, produce the recognized original and original achievements of the community of scientists, and achieve several major breakthroughs of milestone significance, which in turn promotes the academic influence towards the forefront of the international community.

Explore the reform of infrastructure construction and operation mechanism, form a world-class large scientific device group, and build an important foundation platform of national innovation system, which in turn creates an important node of global innovation network.

Focusing on the problem-oriented principal, promote the interpenetration and integration of related disciplines, break down the discipline barriers, and create the thrusters and incubators of interdisciplinary and emerging disciplines.

Gather international first-class research teams, cultivate cutting-edge research talents with international vision and outstanding innovation ability, and generate a batch of international award winners such as Nobel Prize, Turing award, and Pritzker award.

Carry out academic exchanges of major international influence, establish substantive cooperation with world-class universities and research institutions, and promote CNSC to become the most intensive science center for global scientists' visiting.

Establish an autonomy and open scientific research environment, build a new mode of international managerial philosophy for managing the scientific research organization, and create the cultural soil of academic highland.

4.2 Technological Innovation Geared towards the Country's Major Needs

A large number of original breakthroughs in frontier key core technologies should be achieved to address the major needs of the national forward-looking strategic areas.

Technological innovation should be ensured to guarantee the national security, including technological support in the fields of energy security, food security, cyber security, ecological security, biological security and national defense security.

Making the strategic emerging industry cultivation task as the driving force can effectively support and lead the technological progress of the industry. This will benefits the output of major technical systems, technical equipment and systematic solutions.

Relying on the infrastructure construction and operation with large scientific device groups, new technologies should be generated to provide advanced technological means for interdisciplinary research.

It is highly encouraged to promote the transformation of scientific and technological achievements, integrate the development of industry, universities and research institutes, and promote industrial innovation with technological innovation.

Multi-disciplinary and cross-disciplinary personnel training should be conducted, which continuously provides high-level, practical and cross-technical leading talents for industrial development.

4.3 Management Innovation towards Large and Complex Systems

Explore new models of sharing resources and results among governments, institutions of higher learning, research institutes and enterprises, form new mechanisms of complementary advantages and open flow, and strive to break through institutional bottlenecks.

Promote the innovative exploration and trial, establish a flexible and effective organizational structure for operation and management, explore a council dominated by scientists, and handle the relationship between the leadership of the council and the decision-making of scientists.

Promote the innovation of talent management mechanism, improve the treatment to strengthen the guarantee and encouragement effectively, create a relaxed scientific research environment, and form a strong talent magnetic field effect.

Promote the construction of classified science and technology evaluation system, and fully mobilize the initiative of scientists and various innovation subjects to participate in coordination.

Promote innovation of science and technology policies, including intellectual property policies, science and technology and finance policies, etc.

4.4 Innovation Diffusion Oriented to Domestic and International Regions

Promote the incubation of key core technologies. Through the establishment of cooperative research and development agreement mechanism, the advantages of basic research such as institutions of higher learning and research institutes are transformed into advantages of technology incubation.

Promote effective transfer of scientific and technological achievements. Institutions of higher education and scientific research institutions are highly encouraged to carry out the responsibilities of transferring and diffusing the scientific and technological achievements by means of auction, transfer, licensing, price, and investment.

Promote efficient transformation of scientific and technological achievements. Through the development of the scientific and technological achievements transformation functional platform and the scientific and technological achievements industrialization base, the construction of innovation chain, transformation chain, the complete chain of mutual support industry chain.

Promote the cross-regional diffusion of scientific and technological achievements. The role of source should be established to supply and facilitate the transregional transferring and diffusion of CNSC scientific and technological achievements in the Yangtze river delta region, the Yangtze river economic belt and the Beijing-Tianjin-Hebei metropolitan region.

Participate in the processes of international innovation diffusion. The global flow of scientific and technological innovations could be prompted through participating in the processes of establishment of innovation BBS, technology trade fairs, and industrial exhibitions with broad international influence.

5. Suggestions on the Establishment of CNSC Policy Guarantee System

In recent years, the Chinese government attaches great importance to the establishment and improvement of the policy system of scientific and technological innovation; therefore, forming a strong guarantee for the development of national science and technology. However, based on the operational requirements of CNSC, it is necessary to further improve, break through and innovate related policies in order to ensure the accelerated development of CNSC by accelerating the improvement of the policy system.

5.1 Accelerate the Improvement of Policies for Talent Development

Improve the policy competitiveness of talent gathering. First, it is necessary to implement an active and open policy to attract high-end talents inside and outside. Through formulating more internationally competitive living allowances and funding standards, the high-end talents overseas, especially the Nobel Prize winners and Turing award recipients, are likely to be attracted. Second, a more flexible and diversified policy of gathering innovative and entrepreneurial talents should be implemented. In doing so, a talent introduction and training plan could be formulated, as well as living subsidies and funding supporting policies for scientific and technological innovation talents, entrepreneurship leading talents, and outstanding young talents can be realized. There is, in principle, no specific limitation on the number of outstanding individuals and teams. At the same time, through improving the standards of scholarship funding and helping solve the problems of working in China, the scale of overseas students should be expanded to optimize the structure of overseas students.

Increase the attractiveness of talent incentive policies. First, in order to improve the incentive policies for talent evaluation, CNSC can establish a talent evaluation system by classification. The key point lies in the establishment of compensation policies with market value as the core, as well as emphases on both material and spiritual incentives. In April 2017, the Shanghai tax bureau initiated an attempt to levy the personal income tax of 1.03509 million yuan derived from the transformation of scientific and technological achievements, which was the first case in China.

Improve the policy support of talent protection. First, the talent service security policy should be improved,

including the talent apartment policy, education for children's preschool, education resource preferential policy for compulsory education stage, and spouse work arrangement policy. Second, the foreign talent service policy should be improved, including the permanent residence system for foreigners, relaxing the conditions for scientific and technological innovative talents to obtain the right of permanent residence, setting up the service window for foreign talent, developing the international medical settlement system, and providing efficient and convenient exit and entry services.

5.2 Accelerate the Improvement of Technology and Finance Support Policies

Optimize scientific, financial and fiscal policies through innovation. More direct financial input should be provided, and investment in the construction of major scientific research facilities should be increased, and supporting CNSC to conduct basic research and applied basic research should be encouraged. Meanwhile, through fiscal subsidies, tax preferences, tax exemptions and other policies, social forces such as enterprises are leveraged to initiate the scientific and technological innovation activities. An example is the "innovation alliance" project initiated by the German federal government in 2007 which utilized the investment of only 600 million Euro to leverage the supports from the social capital investment—3.6 billion Euro.

Support the strengthening policies of technology and financial market. Specifically, the development of science and technology banks should be supported, setting up a science and technology finance franchise should be encouraged, loan access requirements should be reduced, intellectual property pledge financing should be executed strictly, the credit approval process should be optimized, the loan risk tolerance should be moderately increased, and vigorously develop science and technology credit and technology financing should be guaranteed in the businesses activities. Additionally, in accordance with the principle of "government-led and market-operationalized", state-owned enterprises and social investors should be encouraged to engage in innovation and entrepreneurship through jointly setting up angel investment funds, entrepreneurship guidance funds, venture capital funds and industrial development funds.

Promote and improve policies on scientific and technological financial services. The government can encourage innovation in scientific and technological financial services through issuing various policies such as government procurement, fiscal subsidies and risk compensation. Alternative activities can also be implemented, including encouraging the development of science and technology financial information service platform, establishing the financial road of science and technology center, organizing capital exchange meeting and information release activities frequently through combining on- and off-line methods, and promoting the project cooperation between holders and capital parties of scientific and technological achievements. In doing so, the comprehensive financial services can be established to support science and technology innovation.

5.3 Speed up the Improvement of Intellectual Property Protection Policies

Strengthen the protection of intellectual property continuously. First, the policy of application for identification and protection of scientific and technological achievements should be improved. Such problems as unclear ownership of scientific and technological innovations should be effectively resolved. Second, the information retrieval and inspection platform of scientific and technological achievements should be established and improved to avoid the repeated development and infringement of scientific and technological achievements. Third, the system of quick response and rights protection assistance for the investigation and handling of intellectual property infringement should be improved, which is likely to incorporate the information of infringements into the social credit record. Fourth, the compensation for intellectual property damage should be increased, and the punitive compensation policies should be promoted. Fifth, through improving the protection measures of trade secrets, the application of behavior preservation in the trade secrets field can be actively explored. Finally, the important role of intellectual property court in Beijing, Shanghai, and Hefei, should be highlighted in intellectual property trial.

Improve the international protection of intellectual property rights effectively. In CNSC, innovation resources need to be allocated globally, and innovation results need to be exchanged internationally. This requires adaptation to the international intellectual property policy system. On the one hand, it is important to actively study and adapt to the rules of the international protection of intellectual property rights, especially the international intellectual property rights (TRIPS), the Paris convention for the protection of intellectual property rights, the patent cooperation treaty (PCT), the Madrid protocol, Berne convention, the world intellectual property organization copyright treaty (WCT) and other international intellectual property treaties. On the other hand, CNSC should use the international intellectual property protection policy to not only protect its own innovative results but also effectively avoid its own infringement.

5.4 Speed up the Improvement of Transfer and Transformation Promotion Policies

Optimize policies to support the transformation of scientific and technological achievements. The formulation of supporting measures (e.g., law and regulations) should be accelerated to promote the transformation of scientific

and technological achievements. The outdated regulations and regulations should be updated or deleted. The scientific research institutions and higher educational institutions should be encouraged to transfer scientific and technological achievements to other organizations by means of transfer, licensing or price-setting investment. Free grants, low-interest loans, tax incentives, and venue rent relief policies should be provided to establish in utilizations of the technology investment by research teams. Priority support should be given to projects that can significantly improve national security capacity, improve the efficiency of military and civilian transformation, promote the efficiency of energy consumption, and improve the quality of people's lives through government procurement, financial support, demonstration and promotion.

Improve the policy of information disclosure of scientific and technological achievements. The construction and improvement of CNSC scientific and technological achievements information system should be accelerated. The connections with the national scientific and technological management platform, the local scientific and technological achievements database, and the scientific and technological achievements identification and registration system should be strengthened. An integrated scientific and technological achievements information system should also be established. With regard to the areas of less state secrets and trade secrets, essential public service (e.g., releasing the scientific and technological projects, progress of projects, and the scientific and technological achievements) should be initiated. Meanwhile, the standardized evaluation of scientific and technological achievements should be promoted, and the efficiency of their transfer and transformation should be improved.

Standardize the foreign transfer policy of scientific and technological achievements. On the one hand, the censored scientific and technological achievements are highly encouraged to be transferred to the "One Belt and One Road" countries or regions. In doing so, the diplomatic role of science and technology can be fully strengthened. On the other hand, a strict review system should be established to assurance the national security. Specifically, the catalogue of scientific and technological achievements should be prohibited or restricted from transferring abroad. Moreover, more attention should be paid to introduce foreign advanced scientific research achievements and scientific and technological management experience, which may improve the level of management, infrastructure construction, and operation of technology in China.

6. Conclusion

Through a series of policy analyses, the present study proposes that CNSC has four innovative functions—i.e., knowledge innovation oriented to the world's scientific frontier, technology innovation oriented to national significant demand, management innovation oriented to large-scale complex systems, and innovation diffusion oriented to domestic and international regions. Based on the operational needs, suggestions are proposed to improve the policy guarantee system in CNSC, including talent development promotion policy, science and technology finance support policy, intellectual property protection policy, science and technology achievements transfer and transformation promotion policy, etc.

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