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STUDY OF INNOVATION AND TECHNOLOGY IN CHINA

POLICY BRIEF

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Evolution and System Characteristics of China's Science, Technology, and Innovation Policies

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Chinese science and technology (S&T) policies in a modern sense can be traced back to the late nineteenth century. With the Opium War as the turning point, China embarked on the development of modern science and technology based on traditional Chinese values imbued with modern Western ideology. Looking back, although that moment was long ago, the idea to rejuvenate the nation with modern science and technology has been lingering throughout the modern and contemporary history of China, and has evolved into a main line and a social consensus deeply integrated into contemporary Chinese culture.

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The most practical way to study the historical evolution of something like China's S&T policies is to divide it into several stages based on the overall background, milestone events and their measurable effects, although such division may not be accurate. In discussing China's S&T policies, they can be framed as those issued and implemented since 1978 and the 30 years since China's reform and opening up. This is not just because the author personally experienced this period, but because this uninterrupted period of reform and opening up made it possible for China's real modern S&T progress. Prior to this period but since the founding of modern China, China's S&T policies were interrupted by frequent political movements, foremost of which was the Cultural Revolution. Since then, such keywords as openness, markets, competition, liquidity, innovation, wealth, talent, property, and venture capital began to enter people's minds, which became the basic concepts for the making of China's S&T policies.

We can divide the evolution of China's S&T policies into two phases with different time spans.

The first phase (1978–2003) starts with two important political conclusions of Deng Xiaoping, namely "science and technology constitute primary productive forces," and "intellectuals are also part of the working class." These conclusions helped establish the central role of science and technology in China's economic and social development and acknowledged the political identity and social roles of personnel. With the political background of "economic development as the central task" and implementing "reform and opening up," on one hand, China began its industrial transformation and S&T development with the political orientation of introducing advanced technologies and quickly narrowing the gap in S&T with foreign countries. China successively initiated the National High-tech R&D Program (863 Program) and the National Basic Research Program (973 Program), which remain mainstream national programs today, and on the grass-roots level, the Torch Program (regarding high-tech development zones) and the Spark Program (regarding industry in rural areas). On the other hand, in terms of policies, China set the political tone of "promoting the close integration of S&T with social and economic development," marked by the first national Medium- and Long-term Plan for S&T Development following reform and opening up (drafted in 1979) and the industrial technology policies initiated in the mid-1980s.

China's S&T policy-making has always been accompanied by S&T system reform. In the mid-1980s, while introducing foreign investment and advanced technologies on a massive scale, China began its S&T system reform, featuring cuts on direct government financial disbursements for scientific research institutes and permitting researchers to go into business. The direct result was that a large number of research institutes were forced to orient towards enterprises and the market.

Some entrepreneurial researchers broke away from the original system and founded companies such as Lenovo. By the late 1990s, the vast majority of research institutes originally affiliated with different government departments were converted into enterprises, and researchers forming companies became a no longer surprising phenomenon.

The reform on the "stock" also led to the great changes in the "increment." Beginning in the 1980s, some new elements to promote innovation became the focus of China's S&T policy-making, including high-tech industrial zones, university S&T parks, business incubators, productivity promotion centers, venture capital, and the Growth Enterprise Market.. To date, there are 105 high-tech zones, more than 700 business incubators, more than 1,500 productivity promotion centers, and thousands of active venture capital firms.

The second phase (2003 to present) was marked by the drafting of the Outline of the National Plan for Medium and Long-term Scientific and Technological Development (2006–2020). It can be further divided into two sub-phases: 1) strategy research (consisting altogether of 20 topics for strategy research) and 2) formal promulgation along with a host of supporting policies in the 2006 National Science and Technology Conference.

The strategy research phase of the Outline mobilized about 2,000 experts, researchers, entrepreneurs, and government officials in various fields and disciplines. It was a process of gaining comprehensive understandings of China's national condition, global trends, and directions for S&T development, as well as a process of reaching strategic consensus, highlighting strategic priorities, and making preparations accordingly. The key points of the research include:

- In the planned period (by 2020), China's GDP possibly may successively surpass that of Japan and the United States.
- China must accelerate the transformation of its economic growth model, currently dependent on investments, labor, and the global market.
- China must improve its indigenous innovation capacity and raise its position among the global competition. It must set priorities in S&T development so as to create new economic departments and to resolve the acute problems in sustainable development. Concurrently, a more balanced layout of S&T development should be implemented.
- In order to foster innovation, China must push for system reform, the core mainstay of which is the enterprise, and fully extend the role of the market.

- China must place more emphasis on the exertion of individuals' initiative.
- China's national innovation system should be more open.

Another important change is that at the same time of the promulgation of the Outline, China issued sixty supporting policies that cover ten areas.

Currently, we are conducting the mid-term evaluation of the Outline. It can be said that the Outline has had an enormous impact on China's economic and S&T development. In 2012, China's overall R&D investment exceeded 1 trillion RMB. The number of China's scientific papers and invention patents ranked, respectively, number two and one in the world, and the number of China's R&D personnel reached 2.8 million person-years.

In sum, there are several prominent characteristics in the evolution of China's S&T policies and system.

1. Continuity and consistency in strategy: To a certain extent, the history of modern China's economic and social development is a history of considering S&T development as the path to achieve "the rejuvenation of the nation and the prosperity of the country" (*minzu zhengxing, fuqiang guojia*), from the early period's slogan "marching forward to science" (*xiang kexue jinjun*) to the Cultural Revolution's "modernization of science and technology" (*kexue jishu xiandaihua,* raised as one of China's "four modernizations") to Deng Xiaoping's well-known statement during the reform and opening up (science and technology are the primary productive forces), and finally to later generations of central government leaders who all put science and technology in a central position in China's development. Such continuity and consistency in strategy, on one hand, has ensured that the promotion of S&T development remains a focus of central and local governments in their decision-making process. One the other hand, it ensures that related policies maintain continuity. On the technical level, since the reform and opening up, China's planning and programming system has undergone fundamental changes, yet S&T development plans have always served as a key component in the national social and economic development plans.

A similarly important point is that local governments maintained policies highly consistent with central policy decisions, allowing policies of the central government to be effectively implemented by all levels of the government.

2. Practice, study, re-practice: On one hand, China's S&T policies borrow widely from the experience of foreign countries, such as the concept of "innovation" introduced in the mid-1980s, productivity promotion centers established nationwide based on the experience of Japan and Taiwan in serving SMEs, business incubators based on the U.S. experience, venture capital, the Growth Enterprise Market, and the Law on Promoting the Transformation of Scientific and Technological Achievements adopted in 1995 and based on the study of the laws on the promotion of the transformation of S&T achievement (technology transfer) of the United States and other countries.

On the other hand, the policies are also continuously targeted at addressing problems that occur in practice, through design, evaluation of effects, and readjustment. For example, in the past China's S&T policies placed more emphasis and attention on supply-side policies, such as increasing S&T funds, establishing various R&D institutions, and so forth; however, in the new century, promoting innovation activities through leveraged tools, especially demand-side policies, is increasingly stressed.

3. Policies give more room for innovativeness: China is a country with multiple levels of administrative and financial systems. It is also a country with significant regional differences and disparities between urban and rural areas. Therefore, the design of central-level policies needs to consider general institutional problems. At the same time, this causes some national policies to have different effects in different areas. In this sense, within a national policy's "large framework," local governments are given specific authority to implement the policy, allowing said policy to be tailored to local practices in creative ways. This has become a very distinguished characteristic of China's science and technology policies.

4. Piloting and demonstration: As an important method of this type of creativity, when original policies undergo major revisions, or when the effects of policies are uncertain, or when the influence of policies are complicated, China frequently will appoint one or more regions as pilot regions to implement policies under a "controlled" scope.

The latest example is the establishment of Zhongguancun High-tech Zone in Beijing, Zhangjiang Hi-tech Zone in Shanghai, and East Lake High-tech Zone in Hubei as "Innovation Demonstration Zones." The main policy goal is to resolve the problem of ownership of S&T achievements (which involves the management of state-owned assets), allocation of the profits from achievements (or motivation mechanisms), and tax policies regarding treating S&T achievements as stock equities.

The piloting policy has always been a process of intensive policy evaluation. Many departments—such as the Ministry of Science and Technology (MOST), the National Development and Reform Commission (NDRC), the Ministry of Finance (MOF), the State Administration of Taxation (SAT), the Ministry of Education (MOE)—participate in the formulation process. After being implemented for a time, an evaluation team composed of ex-

perts conducts comprehensive evaluations of policies. These evaluations aim to discover problems that arise during the controlled demonstration, including its possible influence on the original policies, the effects of the policy, and its feasibility.

5. Coordination among departments: The formulation of innovation policies frequently involves multiple departments; they are not simply R&D policies. Although the promotion of technological inventions and technology transfers have always been important components, innovation policies will inevitably involve finance, taxation, consumption, and capital markets, and formulating such policies falls into the responsibilities of different departments of the State Council. Therefore, an inter-department coordination mechanism is needed.

In general, there are several patterns of how this coordination mechanism is established. The first is policy formulation led by one department, which often elicits the participation of additional departments. For instance, currently twenty-one departments are involved in the amendment of the Law on Promoting the Transformation of Scientific and Technological Achievements and each is responsible for the drafting of specific articles. Therefore, the coordination of various departments is achieved through the process of policy research. A second pattern occurs when the policy of a particular department involves the functions of other departments; a "joint signing" mechanism is implemented, for example through an official announcement soliciting opinions. A third pattern, which is used more frequently, is occasional, unscheduled consultation between departments. For instance, MOST has formed consultative mechanisms with the People's Bank of China, the China Banking Regulatory Commission, the China Securities Supervision Commission, the China Insurance Regulatory Commission; topical consultations with the NDRC, the MOE, and the Ministry of Industry and Information Technology; and regular consultations with governments of all China's provinces and municipalities.

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