Government as the Platform Provider in the Triple Helix Perspective: Evidence from Technological Innovation Service Platform in China

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Abstract:

The triple helix approach states that government can play a constructive role in promoting the dynamic interactions between academia and industry. Based on the case study of "National Technological Innovation Service Platform (NTISP)" which has been developed to integrate the innovation resources in China to improve innovation capabilities, this research argues in the perspective of triple helix that the Chinese government is playing roles of building a platform in promoting innovation activities, but not directly involved in the interaction between the university and the industry.

Key Words:

National Technological Innovation Service Platform, Triple Helix, innovation capabilities, SMEs

1. Introduction

The triple helix approach states that government can play a constructive role in promoting the dynamic interactions between academia and industry.

In March 2008, in his report on Chinese Government work in the next five years, the Chinese Premier, Jiabao Wen, announced that China will put into effect a program of "National Technological Innovation Service Platform (NTISP)" to strengthen China's science and technology infrastructure and support technological innovation of enterprises, especially SMEs (Small and medium enterprises).

Generally speaking, the NTISP has been developed to improve innovation and linked to sectors based on the generic and crucial demands of enterprises in the specific sectors. NTISP integrates the innovation resources (e.g., knowledge, facilities, and skilled people), which are

present in enterprises, universities, and research institutes, as well as the Platform guides the concentration of factors of innovation in enterprises.

The government is not directly involved in the interaction between the university and the industry, but to provide a platform as a platform provider. Universities and enterprises are as users or members of the platform to exchange information and trade technology and knowledge, that is to say, the tripartite interactions are reflected in activities within the platform. The platform will enable both universities and enterprises to participate in and to achieve the goal of information exchange and technology transfer. Therefore it will act as a multi-task carrier for production, research and application of science and technology resources. And it is expected to promote innovation activities and to gather resources in an effective way for businesses, as well as to solve contradictions in economic operations and strategic initiatives. Scientific and technological innovation is a shared business for the government, research institutions and industry.

This research argues in the perspective of triple helix that the Chinese government is playing roles of building a platform in promoting innovation activities. Upon which the following part is organized as follows. Section 2 presents the state of the art of the Triple Helix theory. Section 3 addresses the research focus on the status and roles of the existing programs in the Chinese national innovation systems. Section 4 introduces the Chinese Government's role of constructing a platform, National Technological Innovation Service Platform (NTISP) in the perspective of Triple Helix theory. Section 5 depicts the findings and implications. Section 6 concludes with contributions.

2. The state of the art of the Triple Helix theory

Triple Helix is a spiral and dynamic model of innovation that captures the emerging multiple reciprocal relations of university, industry and government at different points in the process of knowledge capitalization. University, industry and government are abstracted as three different however intertwining helices. During the process of transforming knowledge into productivity, the three institutional agents maintain their independent status, while keep close cooperation and interactions with each other, and the interactions among them is the key to improve conditions for innovation and to promote the spiral of innovation to keep rising.

Apart from a movement toward collaborative relations among the three major institutional spheres, the triple helix model comprises another basic element: the university can play a prominent role in innovation in such know-intensive society, the reasons lie in that it bears the traditional tasks of research and teaching. The first mission of teaching endows the university with human resources of high mobility through a continuous process of students' admission and graduation. These undergraduate and graduate students are the inexhaustible source of new ideas and innovation, which helps faculty to recruit new members for the research group as well as provide new blood for government and industry. The second mission of research also embed a knowledge and technology transfer capability, for instance, the research on DNA may give the professors an opportunity to establish a firm doing bio-technology business. When the business opportunities emerge in the university, the university is driven to undertake the "third mission" of direct contributions to industry, which highlight a "second academic revolution" since the Second World War. It is the third mission that has the academia be analyzed in terms of markets and become a key player in the triple helix of university- industry-government relations in the knowledge-intensive society.

The triple helix model can be evolved from two institutional arrangements due to historical situations in different countries: laissez-faire model and etatistic model. laissez-faire model consists of separate institutional spheres with strong borders dividing them and high circumscribed relations among the spheres. Each sphere take its own role for granted: university concentrate on teaching and basic research, hence it is a provider of pure scientific knowledge and qualified personnel which will flow out of the university silently in the form of publication and graduates; industry and government recruit graduates from universities, the former aims to make profits and the latter aims to make and maintain the rules.in the etatistic model, the government takes a leading role, and it encompasses the universities and industry and directs the relations between them. In this case, the three helices are in a state of inequality with the government as driving force of a spiral, and the remaining two are rotating around it. Upon the two models, there has been two trends toward triple helix: on the one hand, university and industry are to be more independent of government, nowadays this trend is advocated in some countries as shock therapy to reduce the role of the government; on the other hand, the three institutional spheres are come to greater interdependence, and even with hybrid organizations emerging at the overlapping institutional spheres. Universities, industry, government all can be leading institutions for innovation, thus a triple helix is not stable. However interactions among the three spheres lead to achieving dynamic balance, resulting in a higher degree of interactions in the triple helix.

The development and evolution of triple helix generally will experience the following 3 phases: the first phase is internal transformation within each institutional sphere, for instance, companies with an industry seek cooperation or strategic alliance; universities promote students or scholar exchange programs; political elites become more willing to consulting others. The incentives of sharing within their own helices will upgrade the sphere itself. The second is the influence each institutional sphere upon another. Not only by maintaining its traditional core role each institutional sphere links with the others, but also by taking or overlapping the roles of the others. For example, the Chinese Government proposed “National Technological Innovation Service Platform (NTISP)”, and the policy will directly encourage universities to provide service for firms and establish new firms based the research results. In this sense, the government assumes some tasks of identifying market needs which traditionally assumed by universities and firms. Taobao, a C2C web site in China, builds a Taobao University to provide training on E-commerce, which denotes that the company has bearded some mission of educating individuals. The third is the creation and formation of a new overlay of triple helix. Since the triple helix is a complex dynamics composed of sub dynamics like market force, political power, institutional control, social movements, technological trajectories and regimes, which are experiencing continuous innovations and transformations under the pressure of changing environment, there is an endless transition for the overlay of triple helix.

One can also look at the overlapping of spheres as involving knowledge, consensus and innovation space, upon this consideration, the stages of knowledge-based economic development are to be summarized as knowledge space, consensus space, innovation space, there is no necessary order to this sequence. The creation of a knowledge space focus on improving regional innovation capability by concentrating on related R&D activities and other relevant operations. To transform knowledge spaces from potential to actual sources of economic and social development, it is necessary to create a consensus space. A consensus space is an access to bring skilled people from different organizational or academic backgrounds together for generating new strategies,

ideas and thoughts. The third stage is the creation of an innovation space to realize the goals articulated in the consensus stage, and it is a organizational mechanism characteristic of establishing and/or attracting public and private venture capital to provide technical and financial assistance to start new firms.

In recent decades, the governments globally have created a variety of mechanisms to intensify the process of knowledge based economic development. These attempts include establishing funds such as public venture capital to support R&D to research institutions, setting up technology transfer offices that arrange joint projects for industry and academia. These activities have prepared governments to provide a hybrid organizations emerging at the interfaces. The hybrid organization can be proposed in the form of programs to support entrepreneurial development in situations where private venture capital finds it too risky to venture. In this sense, these programs have acted as public entrepreneurs extending the role of government from the macro factors affecting innovation such as interest rates to the micro conditions of innovation.

3． "National Technological Innovation Service Platform" (NTISP)

In March 2008, in his report on Chinese Government work in the next five years, the Chinese Premier, Jiabao Wen, announced that China will put into effect a program of "National Technological Innovation Service Platform (NTISP)" to strengthen China's science and technology infrastructure and support technological innovation of enterprises, especially SMEs (Small and medium enterprises). To be specific, The NTISP encompass a series of scientific and technological innovation programs which aim to effectively allocating and sharing such resource as knowledge, facilities, and skilled people which are present in enterprises, universities, and research institutes, as well as the Platform guides the concentration of factors of innovation in enterprises.

Technological Innovation, on the basis of the linear model, can be roughly divided into six phases, i.e., basic research, applied research, test development, engineering, diffusion and industrialization. The existing programs play a role in one or several of the six phases, which are summarized as follows.

1．The State Key Laboratory is to enhance the role of universities and research institutions in the original innovation. Therefore, the State Key Laboratory put much emphasis on basic research work, and it also bears some of the applied research work.

2．National Engineering Technology Research Center and the National Engineering Research Center act a "bridge" between science &technology and industry. It has focused on strengthening the interactions between phases from basic research to the final industrialization. Hence it will indirectly facilitate the technological diffusion and industrialization.

3．Productivity Promotion Center builds bridges between the communities of the small and medium enterprises(SMEs), government agencies, research institutions, educational institutions, financial institutions through the integration of scientific and technological resources, It aims to help SMEs establish a technological innovation system through the provision of various forms of integrated supporting services to facilitate the flow and sharing of resources in information, human resources, knowledge, technology and capital. Therefore the Productivity Promotion Center focuses on support for technology diffusion.

4．The Business Incubator is also a "bridge" or technology intermediary between venture capital, guarantee agencies, research institutions, start-ups. Business Incubator aims to

commercialize high-tech achievements. It provides the incubation space, development conditions, financing, personnel training, management guidance and other comprehensive incubation services, especially in the start-up phase, to help small and medium sized emerging technology companies grow and scale as soon as possible. Indeed the Business Incubator is for promoting the transitions from pure Science & technology research to economic profit, what it distinguishes is that it mainly supports the growth of high-tech enterprises. Therefore, the role of business incubator is mainly on the phase of technological innovation and the industrialization, as well as some support for the technology diffusion.

5. National Science & Technology Infrastructure Platform at present focuses on basic research, applied research and experimental development. It basically supports the research work in universities and research institutes. (See the Table 1 below)

Table 1 Science & Technology Programs with the respective Technological Innovation Phases

Programs	**Technological Innovation Phases**					
	1	2	3	4	5	6
State Key Laboratory	■	—				
National Engineering Technology Research Center		■	■	■	—	—
National Engineering Research Center		■	■	■	—	—
Productivity Promotion Center			—	—	■	—
Business Incubators					—	■
National Science & Technology Infrastructure Platform	■	■	■			

Note: shadow indicates the key phases government is supporting; dash represents the phase(s) also covered however not the focused by the program. 1, Basic research; 2, Applied research, 3, Experimental Development; 4, Engineering; 5, Diffusion; 6, Industrialization.

The table above shows that the government has proposed corresponding programs or plans at different stages of scientific and technological innovation. These programs or plans almost cover all the aspects of technology innovation chain and complement with each other on their roles and functions. Although technologies more or less transfer from labs to firms via these programs, a large number of scientific and technological achievements are still not put into practical use. We specify several reasons why the scale of capitalization of knowledge is small.

(1) State Key Laboratories are usually part of the department or the faculty, the finance or the human resource mainly depend on the universities and research institutions, therefore they do not have incentive to keep close contact with industry. Less contact, less information on the demand

of industry are acquired by the universities and research institutes as supplier of knowledge or technology, leading the supply side and demand side cannot match with each other in the knowledge-based economy. Furthermore, the interdisciplinary cooperation among the laboratories is not satisfying, the internal management and academic capability differ from discipline to discipline, hence it is difficult to achieve integrated innovation through knowledge integration and interdisciplinary cooperation

(2) National Engineering Technology Research Center and National Engineering Research Center are administered by two different divisions of the government due to historical reforms of the government; the former is by The Ministry of National Science and Technology while the latter is by The National Development and Reform Commission. However they function almost in the same sphere in the national innovation systems. The overlapping and dispersion reflects that the resource allocations can be upgraded to an efficient and effective level and the administrative arrangement may require a reform in concert with the upgrade. Some institutes reform to operate independently due to the government policy, then the channels which they used to acquire basic and applied research achievements from upstream have gradually been fragmented.

(3) Productivity Promotion Centre has greatly overlapped with other scientific and technological programs in China. For example, in 2003, Productivity Promotion Centre put forward seven primary missions, among which "technology development, promotion and demonstration" is also a major task of National Engineering Research Center and the National Engineering Research Center ; "business services for start-ups" is the primary service of Business Incubators. It seems that Productivity Promotion Centre is undercutting the others, resulting in its embarrassing status.

(4) Business Incubators aim to promote hi-tech start-ups and help them to grow, mainly providing the infrastructure for the start-ups. However without provision of core technology, the business incubators are intrinsically flawed in the process of technology transfer. Therefore, in the 11th Five Year Plan the government has clearly pointed out that the connections between Business Incubators and universities and research institutes should be strengthened, thus the Business Incubators can get access to the technology, and universities and research institutions can capitalize their research work at a faster rate.

(5) National Science and Technology Platform currently support basic research and applied research conducted in the major research institutions. Taking into account of SMEs' urgent demand for technology, the platform should focus more on docking with SMEs. The construction of "Technology Transformation Platform" are not fully started; The technological innovation resources and supporting services for a specific industry have not been concentrated, hence the platform can not directly meet the technological innovation needs of the firm or the industry .

In the perspective of triple helix, the technological innovation is a multiple reciprocal process in which the circulations (i.e., movements of people, ideas and skills) and interactions of the three helices is the heart of innovation. Therefore, the innovation policies developed in accordance with the linear model of innovation do not truly capture the essence of innovation, further, the fragmented science and technology plans are not conducive to the optimal allocation of technological resources, which explains why the current science and technology plans cannot integrate science and technology with economy.

On the side of industry, the current government policies and institutional environment in China have constrained the technological innovations of the enterprises, especially SMEs who

have come to meet a bottleneck: First, the resource concentration is in a low level that the elements of the technological innovation (i.e., knowledge, people, ideas, finance) are scattered; the layout is imbalanced among institutes. Second, the interactions among university-industry-government is not active, since the undeveloped interaction mechanism blocked the channels for sharing .Third, the so-called relations between the departments and regions and between central and local authorities have influenced the efficiency of innovation: related divisions of government have difficulty in coordinating the work for an integrated innovation system; there is also some barriers between central and local governments, hence the phenomenon of duplication of resources and lack of resources co-exist. Fourth, the supply of generic technologies and other public goods are inadequate.

In this case, the key to vitalize the stock of resources is to build an integrated hub/platform which will lead all the information, technology, skilled people and other resources converging into it. Based on the existed programs, the first step to build the hub/platform is to connect each program with the others, thus a chain or a network can be formed and each one plays its role at different stages of technological innovation. The six programs/sub-platforms for the constructing a comprehensive NTISP involve the government providing funds to set up platform and maintain the platform function well, the academia providing knowledge and talents to initiate the innovation, the industry applying and participating in the platform. The interactions among academia, government, industry will trigger a win-win game. The university can extend its border in the societies by offering a series of services including research, teaching, training, technology transfer to the industry, designing the blueprints of programs for governments. The government as platform provider has to make rules for the platform to create a better field for all players playing; hence the platform will function well under the active and disciplined environment for the academia and the industry. In turn, the platform as a public good will advertise itself for the government. The industry can promote the production with the application of new knowledge and technology. Therefore, each community has increased its profit and innovation capability by participating in the platform. The hub/Platform is expected to be an effective carrier that enables all the related agents and elements to interact.

4. An orientation to "National Technological Innovation Service Platform (NTISP)"

Firstly, NTISP builds upon the existed programs (i.e., the national key laboratories, national engineering research centers, national engineering technology research centers, productivity promotion centers, business incubators) and other institutions. Thus the NTISP integrates the knowledge and people from academia which are the source of creativity internally, as well as it maintain close relations with industry to capture market needs and gain experience on providing service for enterprises. The NTISP is in some sense a platform where the three helices interact and converge. The concept of "platform" indeed resembles a hybrid organization emerging at the interfaces of triple helix, creating simultaneously knowledge space, consensus space, and innovation space.

Secondly, NTISP establish a dynamic bi-directional mechanism promoting the triple helix of university-industry-government to boost toward innovation both internally and externally. The NTISP differs from previous innovation programs for its bi-directional nature: the government as a seller provides NTISP, the potential end users are from two groups: academia and industry. Activities among university, industry and government on the platform actually create a two-sided

market. The two-sided market is characteristic of both direct and indirect network externalities. (Conceptually, network externalities are categorized into direct network externalities and indirect network externalities, the indirect network externalities are also known as cross-network externalities). The former indicates that benefits to each user group exhibit demand economies of scale as the number of end users on the same side increase. For instance, the more universities and research institutes registered on the NTISP, the more convenient for the registrants to have links, exchange information and share resources with other universities and research institutes on this platform. The latter indicates that the benefits to one user group exhibit demand economies of scale as the number of end users on the other side increase, namely, academia prefers more enterprises participating through the platform, while industry prefers the network participated by more universities and research institutes. Therefore, the two sides depend on each other, the more participants from one side, and the more attractive of the platform to the other side. Not only will NTISP bestow upon institutions a low cost channel through which to reach each other of unprecedented scale but also, it will enable itself become a matchmaker in charge of information from two sides and create a two-sided market. Therefore, by creating the two-sided market the government who is the provider of the platform can update itself to a multiple task taker who assumes matchmaking, providing public goods such as public platform and public rules, managing the platform and other activities with the platform's function and expansion.

Finally, NTISP and the National Science and Technology Infrastructure Platform formed a good complementary pattern. The "research and development platform" under the National Science and Technology Platform focus on providing service for research agencies, especially in generic technology. NTISP focuses on serving small and medium enterprises through the integration of resources, hence it helps to accelerate new technology development, application, diffusion, and industrialization targeting in creating social and economic benefits. The technological innovation capabilities of the academia is a key determinant for the continuous improvement of whole process of innovation, so NTISP needs support from the National Science and Technology Infrastructure Platform who has more experience in relating with academia. Further, the two platforms have overlapping circles: promoting transformation of scientific and technological achievements is an important task both for NTISP and the National Science and Technology Infrastructure Platform. The construction of NTISP is also an opportunity to start the public service platform.

The construction of NTISP gives implications to finding a relatively optimal mechanism for supply and diffusion of generic technology. Based on the analysis above of the positioning of NTISP, a feasible mechanism is put forward: the platform take advantage of more contact with industry to identify and summarize what the industry and the market truly need, then it can initiate generic technology research which is market oriented and will surely start a series of small programs, following by further technology diffusion and industrialization. The effects of the implementation of the mechanism relies on how well the platform functions: First, the platform has good integrating capabilities and is considered as public goods, thus it is born to overcome "organizational failure"or"market failure" during the R & D process.(market failure refers to the inadequate supply of generic technologies due to its positive externalities; organizational failure refers to that a single individual can not meet the needs of the development of generic technology due to its capacity constraints) In this case, it is an appropriate choice to have NTISP undertake the task of generic technology development. Secondly, NTISP is to shorten the "distance" between

innovation sources and recipient thus it will help accelerate the proliferation of generic technologies. In the traditional framework of technology innovation, the flow of technology from the supplier to the receiver greatly depends on the channels, generally the task is assumed by specialized agencies, resulting in low efficiency of technology diffusion. However, NTISP is not an intermediary, it is a platform to enable the direct link between suppliers and receivers, i.e., enable the technology flow directly into the diffusion channel without the blockage of some intermediaries.

In short, to construct NTISP is a very viable and economical choice. The government is not directly involved in the interaction between the university and the industry, but to provide a platform as a platform provider. Universities and enterprises are as users or members of the platform to exchange information and trade technology and knowledge, that is to say, the tripartite interactions are reflected in activities within the platform. The platform will enable both universities and enterprises to participate in and to achieve the goal of information exchange and technology transfer. Therefore it will act as a multi-task carrier for production, research and application of science and technology resources. And it is expected to promote innovation activities and to gather resources in an effective way for businesses, as well as to solve contradictions in economic operations and strategic initiatives. Scientific and technological innovation is a shared business for the government, research institutions and industry.

5. Findings and Implications

NTISP is an integrated and sharing platform based on the existed scientific and technical innovation programs. It includes complicated and reflective subsystems such as physical and information security systems, institutional system and professional human resources systems. Construction of NTISP correlates the research, production and commercialization with an assemblage of talents, technology, technical equipment and other resources for innovation. Though some deficiencies are revealed in the functioning of the platform, it is a relatively attainable mechanism to share recourses from industry to industry, from region to region.

The university plays a more prominent role in every sphere of the platform activities. It builds the platform, for instance, some of the top national labs are linked with and supported by the related departments in the university. It uses the platform as well: by actively participating in the platform the university finds out a way to commercialize knowledge and technology. For the industry, the platform identify and analyze the demands of the enterprises, and then can make the resources to the best use and direct the human resource to flow efficiently among regions and research areas. Therefore the platform is not only a bridge, but also a feed-back mechanism to some regards.

Especially, the platform is a public product and service initiated by the government to speed up the rate of socio-economic development by enhancing the free flow of people and information. The appropriate role of government should be a platform-provider, financing the platform in the construction period and matching the two sides. "government can intervene by helping create a new market or otherwise changing the rules of the game", (Henry Etzkowits and Loet Leydesdorff, 2000), indeed NTISP is creating a two-sided market for exchange of information, knowledge, technology, skilled people and other resource, the government makes rules and regulations for the activities on the NTISP, however it should not control the information flow or resource flow on

the platform. Under the rules and regulations, each community can utilize the platform to take the role of another to some extents and each can benefit from the interactions with another.

6. Contributions

This paper will contribute to the wide body of literature available on Triple Helix thesis. There appears to less discussion on the evidence from developing countries to apply the Triple Helix model, thus the research study on the programs and specific cases in China may maintain the potential to provide potential promising practice model to assist today's leaders in the related institutions to develop a more efficient and effective communication and interaction environment. In this environment the academia, the government, the industry can be driven to engage in extensive and close cooperation above and beyond expectations.

Besides, this paper also highlights the concept of "platform ", which is key to understand the two-sided market theory. The NTISP to some extent is a two-sided market or two-sided platform initiated by the government. The evidence of constructing NTISP in this paper illustrate well that the Chinese government has realized the significance of building up and maintaining platforms to extend its borders.

Reference

[1] Henry Etzkowitz & Loet Leydesdorff. (2000). The Dynamics of Innovation: from National Systems and "Mode 2" to a Triple Helix of University-industry-government Relations. Research Policy, 29: 109-123.

[2] Henry Etzkowitz.(2002). The Triple Helix of University-industry-government: Implications for Policy and Evaluation. Working paper.

[3] Jean-Charles Rochet & Jean Tirole. (2006). Two-Sided Markets: A Progress Report. The RAND Journal of Economics, 37(3):645-667

[4] Jeams Dzisah & Henry Etzkowitz. (2008). Triple Helix Circulation: The Heart of Innovation and Development. International Journal of Technology Management and Sustainable Development, 7(2): 101-115

[5] TU Jun & LI Jizhen. (2006). Analyze on the U.S. Small Business Innovation Policy from the Perspective of Triple Helix Model. Studies in Science of Science, 24(3): 411-416.