

Research on Government-Industry-University-Academy Collaboration in China

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Abstract

This paper deals with Government-Industry-University-Academy (G-I-U-A) collaboration mechanism in China from the perspective of National Innovation Systems (NIS) theory. The focus of the article is on the analytical and methodological issues arising from the G-I-U-A collaboration. How the G-I-U-A collaboration changes in China is identified here. After some review of academic research, the paper reveals the key roles which Government, Industry, University and Academy should play. According to the government behavior in innovation activities, a G-I-U-A collaboration mechanism with Chinese characteristics is provided in the paper.

Keywords

Government-Industry-University-Academy (G-I-U-A); collaboration; National Innovation System (NIS)

1. Introduction

The world economy is becoming ever more dependent on the production, distribution, and use of knowledge, etc. It has been widely accepted that successful innovation is critical to the prosperity and development of a country/region. More and more countries put the innovation research on a high level which is related with the future of a nation. Since Freeman designed the term "national innovation systems" in the 1980s, the concept has been approved by policy makers and academic researchers alike. They have used the concept of National Innovation Systems as a conceptual tool to analyze the current knowledge economy because the approach deals explicitly with knowledge creation, distribution and utilization as the key components of analysis.

Then OECD has put forward the view that NIS is the network systems organized by a series of public organizations and private organizations, such as governments, academies, colleges, industries, enterprises and so on. The activities, collaborations and affections of these organizations determine the diffusion ability of knowledge in a country and the performance of a nation's innovation. We can find that the collaboration among governments, universities, industries, and academies which are the foundations of the National Innovation Systems become inevitably integrated with the NIS. All of the factors which influence NIS will also affect the collaboration among the four elements: government, university, industry, and academy.

In recent years, there has been a marked increase in research that makes use of the system approach to

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studying G-I-U-A collaboration in China. In fact, considering the developing situation in China, we need to absorb the diverse NIS frameworks used in foreign countries. Not only the construction of G-I-U-A collaboration mechanism is urgent, but also the emphasis of systems, environment and policy etc is significant. Thus China should form a framework of G-I-U-A collaboration with Chinese characteristics. It is the principal mission of the country in the new century and also a significant task to realize the aim of *innovative country*³.

The paper is organized as follows. Section 2 reviews the G-I-U-A collaboration in Chinese history. Four stages are classified in the section. In Section 3, we compare some academic arguments from Chinese and foreigners. Then there is a conclusion that G-I-U-A collaboration is suitable for China. Section 4 defines the special roles that four innovative elements should separately play, while Section 5 composes G-I-U-A collaboration pattern with Chinese characteristics. Finally, additional problems are suggested for pursuing the studies.

2. The path of evolvement in G-I-U-A collaboration

As the political history went forward slowly in China, the path of evolvement in G-I-U-A collaboration followed the slow development. The evolution went as follows:?

2.1. Dispersive cooperation (1950s-1970s)

Planned economy is a prominent feature at that time. The government controls all of the industries, universities and academies. Centralization of state power and planned arrangements composed the innovative system. With the pattern, industries was only the unit of production, universities took responsible for a few research. The origin of innovation is academies. Collaboration among those actors is arranged by the government. The cooperation is firstly political oriented, and secondly not an active behavior. In despite of the notable achievement (for example: two bombs one satellite), it is only some sporadic political cooperation. It is fairly hard to form fine collaboration systems as right and obligation is inequality.

2.2. Germination and cultivation (1980s-1995)

The reform and open policy has brought us new development. From 1986 to 1993, the slogan that *science and Technology is productivity?* causes the change of government function. G-I-U-A collaboration at that time was S&T oriented, with the famous strategy of *developing the Country through Science and Education?* In 1992, *University-Industry-Research Program?* was put into practice by Economic and Trade Committee, Ministry of Education, CAS (Chinese Academy of Sciences). It means there is a good beginning of G-I-U-A collaboration. The policy in 1994 of *some opinions about how universities develop S&T enterprises?* indicated a national level of G-I-U-A collaboration was considered.

2.3. Grow up and development (1996-2005)

To boost up the innovative ability, China brings forward the *technological Innovation Project?* with a central part of industries. CAS begins to implement the Knowledge Innovation Program. Some applied academies in CAS were industrialized. From 1999, there were several decisions of constructing the

³ Chinese government bring forward *national S&T long-term planning (2006-2020)?* which establish *constructing an innovative country?* as a new objective.

technological centers, intermediary agents etc. G-I-U-A collaboration begins to grow up. However, the government reacts faintly in the innovation. Good National Innovation Systems call for the support of government but not the single administrative instructions.

2.4. Synergetic conformation (2006-)

This year, discussions about innovation and innovative systems become a hot topic in Chinese society, politics, and industries and so on. There is a climax of research here. How to define the respective role of G-I-U-A and confirm the collaboration mechanism is a pivotal and complex problem. 2006 National S&T long-term planning? marks out the new target of the country 2020 Constructing an Innovative Country. Enterprises should be the main body, and the other elements interact with each other. Government should be the guide and support of the innovation. An effective collaboration system is sketched.

3. Voices from academe: some investigation about G-I-U-A collaboration

The issue of G-I-U-A collaboration is the common attention of governments, academes, and industries for years. However the specific term of 产学研-I-U-A collaboration? is hardly found in the literature. From 2006 NKI? (a famous network of *Knowledge Infrastructure Project* in China), when we search the term by title, there are only 16 articles that match the term. Most of the articles are aim at 产学研-U-A? or 产学研-I-A? collaboration, which always discuss three elements of innovative actors.

In China, the study of 产学研-U-A? collaboration mostly focus on these areas: (a) the importance of 产学研-U-A? collaboration; (b) the case study of 产学研-U-A? collaboration; (c) the problems and countermeasures during 产学研-U-A? collaboration; (d) the mechanism of 产学研-U-A? collaboration; (e) the structure of 产学研-U-A? collaboration; (f) the distribute of benefit in 产学研-U-A? collaboration and so on. The most intensive study done by Liu Li (2001, 2002) analyzed the successful experiences of developed countries from the aspect of government. We would mention, however that the literal explanation of 产学研-U-A? cause the subject fuzziness. Most scholars follow the National 产学研-University-Industry-Research Program? they probed into the relationship and collaboration among industries, universities, academes, while not or less refer to the government.

In fact, the innovative pattern of 产学研-I-A? collaboration has already been the mainstream of research in S&T department and academic communities of foreign countries from 1980s. The term G-I-A is firstly put forward by Japanese. Its central content is to make sure the three elements work together efficiently⁴. This policy made great sense to the innovative capability of Japan. Etzkowitz & Leydesdorff brought out that the subject of innovation: University, Industry, and Government, should connect for the demand of economic development. The three forces related together and formed a Triple Helix (TH). This theory aimed to construct an ideal interaction mechanism of 产学研-I-A? partnership. Hence, the theory of 产学研-U-A? became considering the level of government. During the last several years, some Chinese scholars begin to accept the term 产学研-I-A? when they found 产学研-U-A? is deficient for the innovative subjects. Wang Chenjun (2003, 2005) published a series of theses about 产学研-U-A? by which the Triple Helix theory was introduced in China.

Based on these analyses, we figure out that 产学研-U-A? or else 产学研-I-A? is intent to give prominence to different subjects. With respect to Chinese practical problems, as the peculiar situation, we find government,

⁴ In Japan, the term 产学研 academy? actually involves universities.

industries, universities, and intermediary agents (which haven't been discussed in this paper) play the crucial part in Chinese innovation systems. Accordingly, we offer an explicit attitude that, constructing G-I-U-A collaboration with Chinese characteristics is essential to innovation system.

4. Orientation of Chinese innovative subjects 中国 -I-U-A

Some debates about innovative subjects and status exist for a long time. A great deal of Chinese articles indicate that Industry is the primary subject in innovative activities, whereas the popular Triple Helix theory make University as a potential and marked role in innovation (Godin & Gingras, 2000). Such disquisitions investigate the special part Government-Industry-University-Academy act in innovative activities. But there is not a consistent standpoint. To make out the role of innovative subjects, there are some new explanation (a) innovative activities exist in the whole social and economic movements. (b) regarding the complicated human activities as an integrated part, the over-all activists and groups are the same subjects. (c) if analyses the activities, we find the economic and legal status of activists are equal.

In our study, we take the term 中国 -I-U-A? as an open concept. Government, Industry, University and Academy are the subjects of innovation. They cooperate to produce knowledge, realize science and technology renovation, industrialize the S&T products, and achieve the rational allocation of production factors. The four subjects play different functions in the Chinese systems as follows:

4.1. 政府 government: coordinators

Governments always supply a healthy environment and direct investment for innovation. How to deal with the relationship between market and government is intricate when governments incorporate in the construction of systems. From early experience, the most effective institution is the complementarity between market and government. On the one hand, when market mechanism can make sense, it is due to market to run the functions; On the other hand, when market doesn't work, government should intervene. In China, with the developing situation, the market mechanism is still not efficient. Thereby, governments should set up the goals and establish policies to implement the collaboration among the subjects. Although the government will not be the most energetic subject, it will be a controllable status. Hence, government should be the principal in the collaboration system.

4.2. 企业 industry: innovative power

As we known, governments, academies and universities are the subjects in the innovative activities, but only industries take charge of the central responsibility. Members of scholars discover that giving industry the central position can layout S&T activities better. For China, most of the industries pay more attention to innovation, which now become the central power. Figure 1 shows the R&D expenditure in China by sector of performance. The proportion of industry rose year by year, especially after 2000. Central status of industry is solidified. Only the industries have the incentive to make profit, and they hold the capability of conceiving ideal and making decision. Academies and universities, however, do not possess the inherent motive and lack of market-oriented research.

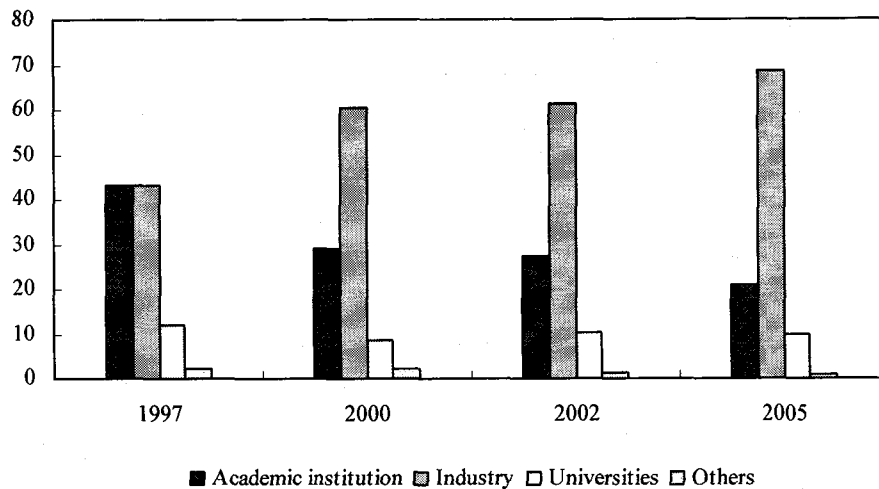


Figure1. 1997-2005 R&D expenditure in China by sector of performance

Source: Ministry of S&T, National Bureau of Statistics of China

4.3. 대학 university: cradle of talent, freedom exploring scientific research

From the attribute of University, it is first of all a nonprofit organization. A majority of universities in China are public schools. The chief responsibility of Universities is to foster person of ability. Then they also take responsible for some basic scientific exploration. Research-oriented Universities means not only cultivation but also engaged in the production, transformation and application of knowledge. There is a spill-over effect to the whole innovation. Fortunately, more and more Chinese universities realize the significance to reform. A lot of progress can be found in this country.

4.4. 연구원 academy: applied research, fundamental, strategic and forward-looking research

In China, academies take on the strategic and fatal S&T problems with respect to national benefit and safety. Since the Pilot Project of Knowledge Innovation Program in CAS (Chinese Academy of Sciences), many applied-oriented academies reinforce the industrialization, while the other basic research agents assisted by finance grow stably. There are two disadvantages during the reformation. Firstly, some scientific academies industrialize the scientific product by interior companies, because of the property problem some industries do not want to cooperate. Secondly, to the fundamental academy, the innovative capability is so weak that we should set up aggregate research agents and constitute new evaluation systems.

4.5. 중개자 intermediary agent: the bridge among I-U-A?

Besides the four elements, intermediary agent is useful in the intricate system. During innovation systems, intermediary agent provide platform for the suppliers and demanders of technology, in the action of communion, support and diffusion. Many countries regard the constructions of intermediary agent as the vital approach for government to put forward diffusion of knowledge and technology. Chinese intermediary agents also offer some helpful methods for SMEs.

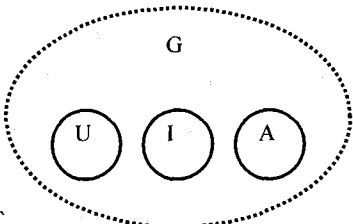
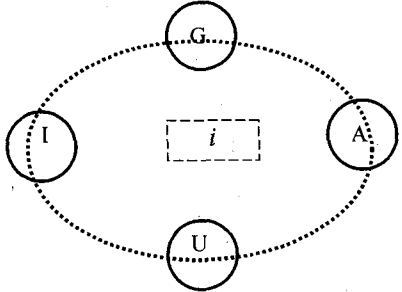
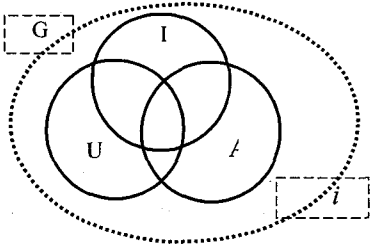
5. G-I-U-A collaboration pattern with Chinese characteristic

Hakan Gergils in Sweden point out that, Innovation System is not a fixed rules but a dynamic and

flexible model. Economic development is carried out by the basic and applied technical exploitation and commercialization⁵. For the cooperation of subjects in innovation systems, 产学研-I-U-A? collaboration should break through the literature understanding. The essential isn't a simple cooperation of organizations, but a separate combination of one subject or multiple subjects to collaborate. Furthermore, there are close movements among subjects and interaction of the integrated group with environment.

Chinese government drives the reformation of S&T system from the planning system to a market system in the past 20 years. Enterprises in China are growing independently from control by the government. Academies and Universities reformed their systems. Toward 产学研-I-U-A? collaboration in national innovation system, the course must be dynamic, open and regulative. With respect to the function of government, the innovation activities follow this route: *omnipresent and centralized of state power* 参与 *articipant selectively and coordinate directly* 支持 *omplementary support and construction of harmonious environment*. Table 1 is the transitional graph of 产学研-I-U-A? collaboration. There are three stages in the course of development.

Table 1 The transitional graph of G-I-U-A collaboration pattern

Stage	Configuration	Significance
Stage 1		<ul style="list-style-type: none"> ◇ U, I, A is owned by the country ◇ Government control and lead the system of U, I, A ◇ Government arrange the exiguous cooperation among the three elements
Stage 2		<ul style="list-style-type: none"> ◇ I, U, A break away from the government, industrialization is put into practice ◇ Government participate in the innovation activities ◇ G-I-A-U collaboration formed ◇ Free environment, intermediary offer assistant
Stage 3		<ul style="list-style-type: none"> ◇ G,U,I,A inosculate spontaneously, innovation activities overlapped ◇ Superposition is played by G,U,I,A together ◇ Government, intermediary offer sustention but not engaged in ◇ All the innovation is drive by market demand

In history, the actors in the innovation system in China are not synchronous and suited. With the socioeconomic improvement, the separate role of G-I-U-A is distinguished. The government begins to join in the innovative activities, advances the cooperation with the other three elements. In the future, once a

⁵ Dynamic Innovation Systems in the Nordic Countries, Hakan Gergils, Sweden SNS, 2005.

perfect market mechanism established, there is going to be a balance between government and market. Government will retreat from the practical movement and construct a fit environment. A new network of G-I-U-A innovation mode can be realized.

At present, G-I-U-A collaboration in China is just come into the second stage in Tab 1. Because of the incomplete market environment, governments promote the technological innovation. In Chinese National Innovation System, Governments, Industries, Universities, and Academies are the main actors with the assistants of intermediaries. But it is doubtless that Industry is the core of innovation, which fulfill a number of S&T assignment. The current structure of innovation in China is showed in Figure 2.

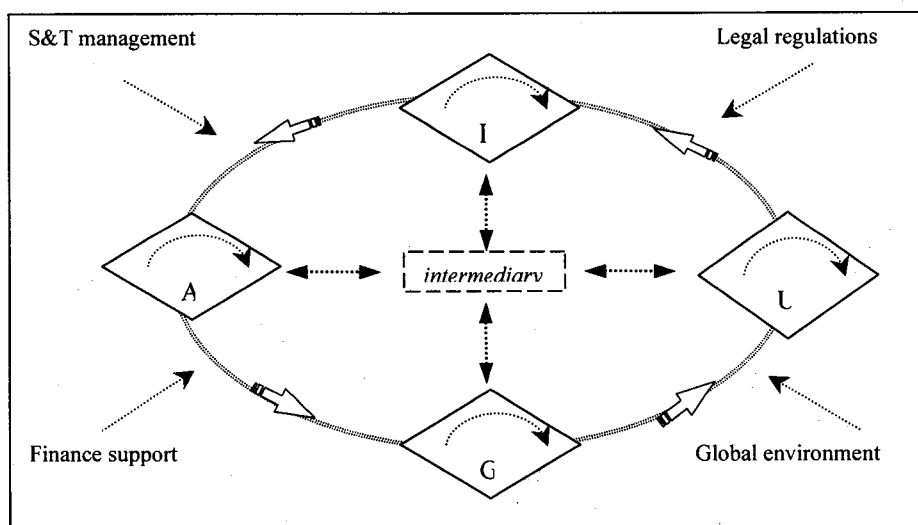


Figure2. G-I-U-A collaboration in China

There is a more and more close interaction among G, U, I, A, in China, with a distinct Chinese 政-工-学-研? collaboration mechanism. In Figure2, the exterior of the circle is outer environment systems, as the interior of the circle is the cooperated actors. Two kinds of relationship exist. The transverse relations include the connection in homogeneous actors, such as enterprises cooperation, academies cooperation, different government department cooperation, and various universities cooperation; the longitudinal relations include the connection in diverse actors, such as government cooperate with industries, academies relate with enterprises, universities and academies set up research centers together etc. In fact, an elementary interaction has been formed. Governments, Universities, Academies, and Industries aggregate as on the circle. The trend of Innovation Systems show that under the guide of government, market mechanism as a basic tool will help to allocate the resources. Intermediary is fostered and regulated gradually.

6. Conclusions

In this paper, we have focused on some analytical and methodological issues which we have found the important things in the analysis of G-I-U-A Collaboration. The collaboration framework is fairly defined and several methodological alternatives are available. Our aim is to contribute to the discussion of four subjects with respect to the analysis of innovation systems.

The figure of G-I-U-A collaboration in China means each element discussed here exerts its own function

on the respective nodes. Moreover, all the elements also plough into the other nodes actively. As long as one node get success, there will a transfer to the next node. This type of operation advances the proficiency and quality of innovation.

There are still a lot of issues for us to investigate. The first issue which seems to in need of further work is that of performance measurement. Given the dynamic national of innovation systems, measuring the performance of those actors at a particular time is not only problematic, but can also be misleading. The most important aspect of performance may be the extent to which the system contributes to long-term economic growth which can only be assessed in retrospect. Constructing the I-U-A? collaboration mechanism is the need of Innovative Country. Hence, there is still a long road for us to progress.

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