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Enlightenment on the Construction of American and Japanese University Technology Transfer Organizations Based on Triple Helix Model

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Abstract: Triple helix provides external innovation environment for university technology transfer organization's operation. American and Japanese governments set dynamic mechanism for triple helix's formation by legislation and provide multi funding sources for the operation of the university technology transfer organizations. Also American and Japanese university technology transfer organizations carry out effective operation mechanism. All the above promote the development of university technology transfer organizations.

Key words: Triple helix, university technology transfer organizations, technology transfer

INTRODUCTION

Etzkowitz and Leydesdorff (1995) firstly proposed triple helix innovation model for university-industry-government relations. Etzkowitz and Leydesdorff pointed out that university and industry began to stretch out to the other side. And the role of government also began to go beyond their traditional role close to university and industry. Etzkowitz and Leydesdorff (1997) proposed that university, industry and government's interaction, cross and overlap constituted the foundation for the development of the knowledge economy. In the new techno-economic paradigm, knowledge production, conversion, application, industrial upgrading and the proper tripartite reflexive interaction are required. Interactive refers to tripartite interaction resulting trilateral network and hybrid organizations such as university technology transfer organizations (herein referred to as TTO[1]); reflexive refers that when each participant completes his mission, he also plays the role of the other participants. Interactive and reflexive relationship was embodied in: in addition to scientific research, university cooperates with the enterprise for application development, so it has the entrepreneurial function; business establishes a close strategic partnership with school; government also actively assists to link business with school. That is to say, no matter which party is involved it should interact with the other two parties. Each participant interacts to promote innovation system spirally and eventually the dynamic triple helix is formed.

Currently in Europe, USA, Japan and other countries, almost all research universities have established university technology transfer organizations and the overall effectiveness of technology transfer organizations is prominent. Learn from the system point of view, triple helix and university technology transfer organizations subordinate one system. Triple helix is the external subsystem of university technology transfer organizations and university technology transfer organizations are the internal subsystem. External subsystem coordinates with the internal subsystem in order to make the whole system in a healthy development and also to promote the implementation of technology transfer. Therefore, from the perspective of system theory, if its external subsystem (triple helix environment) does not match, university technology transfer organization can not achieve the intended goals. Therefore, in order to promote university technology transfer, we must first strengthen the triple helix construction to provide a good innovation environment for university technology transfer organization's operations; secondly, university technology transfer organizations should strengthen their internal management.

AMERICAN AND JAPANESE UNIVERSITY TECHNOLOGY TRANSFER ORGANIZATIONS' EFFECTIVENESS

American university technology transfer organization's effectiveness: Technology transfer organization's model at Stanford University as the representative of TTO model in the United States began to spread after 90 years in the last century. At present, there are about 300 colleges and universities nationwide with technology transfer (licensing) office, these institutions have become an important social force to promote the industrialization of scientific and technological achievements. Since the 1990 sec, the number of American TTO's invention disclosures, patent applications, technology licensing remained stable growth while the university spin-off enterprises increases as referred to Fig. 1 and 2. These new ventures and products are based on new technology

[1]In Japan, such a organization is normally called as technology licensing organization, and is short as TLO.

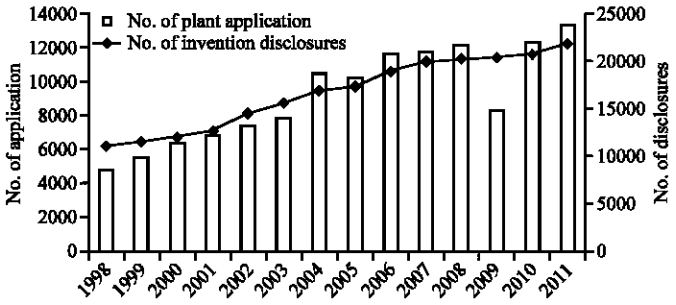

Fig. 1: The number of U.S. university patent applications and invention disclosures[2]

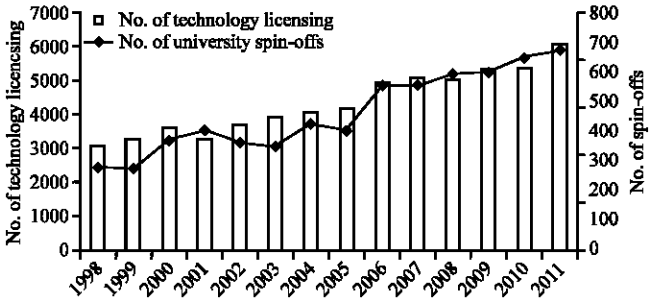

Fig. 2: The number of U.S. university of technology licensing and spin-off companies[2]

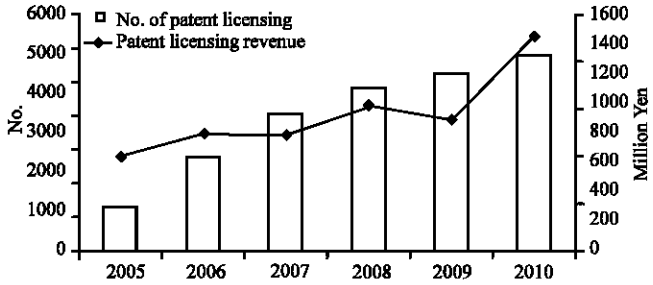

Fig. 3: Japanese university technology transfer's patent licensing number and revenue[3]

to achieve the purpose of technology marketing and enhance the country's competitiveness. This shows that the development of American TTO improves university's intellectual property awareness and technology transfer initiatives and that TTO's technology transfer effectiveness is highlighted.

Japanese university technology transfer's organization effectiveness: The number of Japanese technology transfer organization is from 4 in 1998 to 42 (including the recognition and identification of two types) in April, 2012. Japanese university technology transfer organization's development strengthens the joint research and commissioned research between university and industry. At the same time, the number of university invention disclosures, patent licensing and spin-offs, patent licensing income increase as shown in Fig. 3 and 4. Japanese technology transfer organization successfully promotes the transfer of technology to industry. According to METI survey conducted in 2005, the number of university ventures derived by university technology transfer organization reached more than 1000 in 2005 and each company's average annual turnover was 132 million yen, which economically affected the country to be estimated at up to 3,642 billion yen (Luo, 2008).

[2]Data is originated from AUTM annual report.
[3]Date is originated from Japan's MEXT website reports.

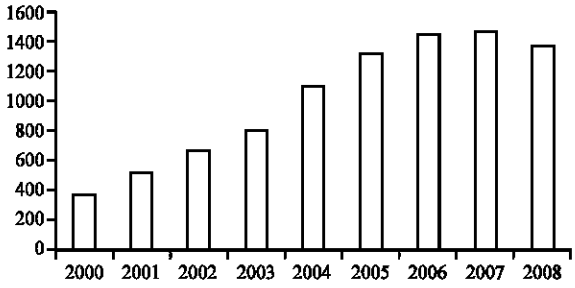

Fig. 4: The number of Japanese university technology transfer's spin-offs

SUMMARY OF DEVELOPMENT MODEL OF AMERICAN AND JAPANESE TECHNOLOGY TRANSFER ORGANIZATIONS

Based on the development of American and Japanese university technology transfer organizations it can be found that both countries enacted a series of technology transfer policies related to university, industry and government for technology transfer organizations' development, such as America's Bayh-Dole Act, Japan's TLO Law which gave impetus for universities and industrial's cooperation and were contributed to university technology transfer organization's construction. University technology transfer organization's standardized development strengthened the cooperation between university and industry. Therefore, from the development of technology transfer organization, both countries follow the "triple helix environment-TTO behavior -performance" reflexive interaction mechanism rather than build the technology transfer organization unilaterally around internal development. The model of formation process and the exact measures for TTO in USA and Japan can be found in Fig. 5.

The development of University technology transfer organizations in USA and Japan follows system theory which provides experience for China's university technology transfer organization. TTOs in USA and Japan have three significant features:

Dynamic mechanism for university-industry-government triple helix formation set by Government's legislation: University technology transfer organizations in USA and Japan achieved remarkable operation results that were directly originated from clarity of intellectual property rights by government legislation, ways to establish university technology transfer organizations which injected motivation for triple helix formation. In such a dynamic mechanism, university technology transfer organization was given the mission of technology transfer and also had a good triple helix operating environment. That is to say, government must introduce policies that sufficiently radiate university, industry and government to stimulate reflexive interaction among these three parties (Bangun and Sukarya, 2012). Although the concrete measures that the governments of the United States and Japan took were different, the general directions of dynamic mechanism formation set by the government were consistent.

America's Bayh-Dole Act stipulated university ownership of intellectual property rights from government-funded research achievements. Coupled with American university's own independence, decentralization principle of intellectual property rights ownership greatly inspired the technology transfer enthusiasm of university, so university had a strong incentive to interact with industry. In the past, complex approval processes of technology transfer led to scientific research shelved and university had no incentive to implement technology transfer, so before the introduction of Bayh-Dole Act, the federal government's patent transfer rate is less than 5%. In addition, Bayh-Dole Act and related regulatory system also set explicit requirements for TTO's construction. And TTO as a communication platform for university and industry actuated deep-level exchanges between the two sides which further strengthened triple helix relations.

Japan's TLO Law enacted in 1998 was a launcher of university-industry-government triple helix relation. TLO Law stipulated the establishment of university technology transfer organization and preferential technology transfer policies for SMEs to strengthen the university's participation awareness in industry activities, encouraging SMEs to interact with the university which actually inspired the triple helix relations to gradually form. Before the introduction of Japanese TLO Law, university research achievements were transferred privately or simply set aside, so the university technology transfer was difficult to form a standardized climate; and non-legal entity identity of Japanese national university became barriers for national university to be involved in triple helix. However, according to Japanese National University Corporation Law in 2004, national university is no longer a government administrative affiliated institution and it is qualified to implement the technology transfer activities independently and also assessed by the third party while the intellectual property rights of scientific research achievements were transferred from the past actual ownership of researchers to university, so direct technology transfer from university to industry became university's urgent needs and the formation of triple helix relations got legal protection.

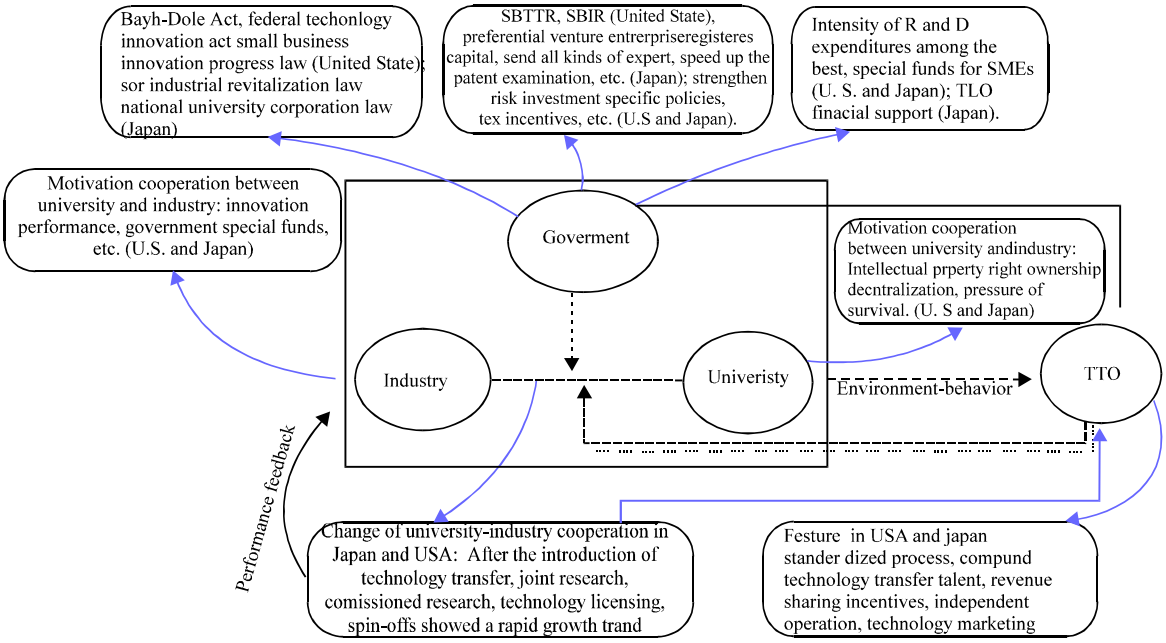

Fig. 5: Development model of American and Japanese university technology transfer organizations

Funding source for university technology transfer organization guaranteed by the government: Either American or Japanese government's efforts to R and D expenditures are quite large and their intensity of R and D spending ranks among the best in the world. The high intensity of R and D spending ensure the subsequent development of research outcomes to provide better technical achievement resources for the implementation of technology transfer. However, from the supply of technology transfer funds, the measures of these two governments are different. USA conducted indirect incentives to guide market operations, such as through the capital gains tax rate cut, venture capital funding adjustment and other means to activate venture capital market, making the technology incubators have a more abundant source of funding. Japan took a combination of direct and indirect funding support and government's direct financial support was relatively large: financial support of a maximum of 30 million yen annually for recognition TLO; budget of 40.2 billion yen for the development of university spin-offs in 2002; budget of 40.5 billion yen for small business innovation; government's payment for patent licensing commissioner and specialized funds related to various types of technology transfer. Combined with the characteristics of their respective market, America and Japan took different types of university technology transfer funding measures to create the conditions for university technology transfer organization to carry out technology transfer.

Effective internal operating mechanism of university technology transfer organization: Internal operating characteristics of university technology transfer organizations in America and Japan were similar. Whether on site or outside the university, University technology transfer organizations basically took the form of enterprise operation and technology transfer managers of university technology transfer organizations as core members were the compound talents; technology transfer process in both demonstrated standardized features. In the technology transfer process, cooperation and communication with the inventor, technology assessment, technology marketing and post tracking were important in the organizations. In order to promote the enthusiasm of the inventor, both two organizations distributed the income inclined to the inventor's interest in the form of a fixed proportion or percentage change. In order to strengthen organization functions, the Japanese government also sent consultants to the organizations to guide technology licensing, patent information mining and utilization, etc. Additionally, university technology transfer organizations in both countries can join the country's association of university technology transfer which helps to improve technology transfer functions and achieve technology transfer diffusion.

CONCLUSIONS

From the results, TTO's operational performance in America is better than that in Japan. But from their respective background, technology transfer models in both countries were successful. From the experience of the two countries, the intellectual property ownership transfer and the establishment of the technology transfer organization were primary factors to promote the triple helix environment. And there are still discrepancies on the issue of intellectual property rights ownership in China which in fact means it difficult to rely solely on the establishment of TTO to promote university-industry interaction. How to clarify ownership of intellectual property rights and further release university's energy to strengthen university-industry's deep cooperation should be focused on. Additionally, social benefit other than its own economic is more important for TTO's operation, so it is difficult for TTO to get profit in the first 5-7 years. Both governments gave a lot of funding support to university technology transfer organizations which could be used as reference for China. In addition, independent mechanism, standardized processes, compound skills of technology transfer managers and effective incentive for inventors are all that we should learn from them.

The model of Japan's university technology transfer organization was drawn on the practice in the United States, so the general operation directions of the technology transfer organizations in the two countries are the same, but there are still some differences. As the non-independent legal entity characteristics of Japanese national university in the past blocked its initiative to communicate with industry which pushed government to formulate a number of consequential supporting policies after Japan's TLO law. And the Japanese government made great efforts to provide funds for development of the technology transfer organization and also participated more directly and in-depth in triple helix which became the main difference between two countries' TTO operation. Chinese universities are mainly public institutions, so governmental funds are a major source of university funding which means China's universities have similar background with Japan's national universities in the past. So, from the overall construction of university technology transfer organization, the model in the United States is worth learning, but the degree of Japanese government involvement in the triple helix also demonstrates exploration significance.

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