Literature Review on the Transformation of Scientific and Technological Achievements

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Abstract. China's institutions of higher learning with a large team of science and technology, has brought powerful technology strength. They create a large number of innovations each year. Scientific and technological achievements, however, that can be implemented in the economic and social benefits seems too less in comparison with the massive amount of achievements, this situation causes the great attention of the society. This paper summarized the status of transformation of scientific and technological achievements, and found out the current problems, so that we can made breakthrough progress in the transformation of scientific and technological achievements.

With the rise of the "Internet +" era, the world began a new round of technological revolution and industrial revolution. Once production factors as the traditional competition pattern is no longer suitable for the current market environment, international competition is also not only competition on the scale and efficiency, but become the competition of the scientific and technological innovation and scientific research ability. These days it is very concerned about the business transformation of scientific research achievements at home and abroad, and the transformation of scientific and technological achievements were studied from different angles.

The Foreign Research Status

"Scientific and technological achievements" is a proper noun in the management of science and technology in China. In the United States and other western countries, vocabulary related to science and technology management, found no similar to the "scientific and technological achievements" referred to in our country. In the United States, it is mainly used to a macro description on the scientific research contribution to the economy, society and science.

Corresponding, "transformation of scientific and technological achievements" on international generally referred to as "the commercialization of science and technology", "technology transfer" and "technological innovation". It is recognized as a system of knowledge transfer in manufacturing products, application methods of production and service, but it does not include the sale or rental of pure goods. It includes: (1) the transformation in the system of knowledge, namely the system transfer from generating knowledge to the use of knowledge; (2) the transformation of technology movement between each link, such as basic research, applied research, development, commercialization of transfer between each link; (3) the new application of existing technology.

We summarize research status from abroad about problems encountered in the process of transformation of scientific and technological achievements, and current solutions, these two aspects.

The Barrier. Rudolph(1992)argues that the personnel attitude in many colleges and universities of science and technology, perfectionist tendencies, the lack of practicality, scientific research ability and incentive system for scientific research personnel and other issues are the important factors influencing the transformation of scientific and technological achievements.[1]

Friedman (2003) found that funds investment in the institutes of colleges and universities in scientific research, talent introduction, profit distribution, and system set to a certain extent, affected the transformation of scientific and technological achievements, through the study.[2]

Davies(1996)、Siegel(2003)studied the cooperation between colleges and enterprises, and found that the scope of information communication and cooperation between university and enterprise, cooperation time and cooperative efforts have greatly influenced the transformation of scientific and technological achievements of colleges and universities.[3]

Schmiemarn (2003). Robchiang (2007)the analysis of countries in Europe and the United States, found in the market economy developed countries, the constraints of the government, especially the intellectual property system which is perfect or not is also affected the transformation of scientific and technological achievements.[4],[5]

Solutions. In the United States, the transformation of science and technology achievements in colleges and universities is mainly promoted through universities technology transfer office. The United States's the earliest technology transfer office established before the First World War, developed in the 1980s. Stanford University of technology licensing office is the most influential. The units created to raise the model, namely, office expenses are spend in income from the transformation of scientific and technological achievements, accounting for 15% of the achievement transformation income. Then, in order to adapt to the demand of the market economy development, it established the Stanford industrial park, the first "silicon valley model of", it is a combination of science, technology, production. Research universities in the United States have established a special team of technology transformation. The staff are the technical manager, have independent decision-making power. They are responsible for the packaging of the University Technology and intellectual property rights, a patent application for decision on whether or not to transfer the achievements, etc.

The British government has a dominant role in the process of transformation of scientific and technological achievements. Since 1986, the British established the system of university research funding and evaluation, so as to promote the transformation of scientific and technological achievements, such as set up the small and medium-sized enterprises oriented "enterprise capital fund" and "the innovation investment fund", introduced the research and development tax policy, etc. Later, British industry has developed rapidly; information services become an important part of the third industry. In order to adapt to the actual situation, the government gradually set up information agencies. Such as Cambridge University founded the "Cambridge enterprise", the average success to help build 5 companies, hatch more than 300 companies so far. Now England set up many liaison agencies, these institutions on the one hand find the market for university teachers and researchers of scientific research, on the other hand introduce business topics and dynamic to the school, this is conducive to cultivate the excellent talents.

Germany has established completed database. Germany is a federal government; the government has no right to interfere the scientific and technological achievements to work. But the federal government has been effectively guided the development and transformation of scientific and technological achievements for a long time. The government in reference to the experience of the United States "silicon valley model" established the perfect database in order to promote the development of science and technology and support transformation of scientific and technological achievements. Applications such as Borussia Dortmund University of science and technology, it's department of information engineering is the largest in NRW all colleges and universities, has a lot of experts. The school set up perfect database, enterprise if interested in it, can cooperate with university to provide the funds, promote the transformation of scientific and technological achievements.

Sweden's scientific research level is currently ranked among the top of the world, it has established the effective capital market, provided seed money for science and technology enterprises. Especially in the scientific research personnel of the funds, Sweden has carried on the deep reform and innovation, including a third of the funding from the government, a third of the funding comes from enterprise, the final 1/3 from academics. In addition, the Swedish developed employment system for research and development of scientific and technological achievements of scientific research personnel, besides the wages and salaries, they have achievements' success dividend income, it's greatly promoting the scientific research personnel's enthusiasm.

France has more than sixty percent of the university participated in the construction of the French island science city; Russia created the Moscow university science park; Japan's organize many university participated in the kansai culture construction of city.

Domestic Research Status

We summarize the domestic research status from problems encountered in the process of transformation of scientific and technological achievements and current solutions, these two aspects.

The Barrier Analysis. Guolin Wu (2002) through research thinks, transformation of scientific and technological achievements is a complex and dynamic process, the characteristics of scientific and technological achievements and the complicated relationship between them is the key factors influence the transformation of scientific and technological achievements.[6]

Zhaoyang Liu(2011), Xiao-mei Kang (2014), and other scholars, research the external factors of the transformation of scientific and technological achievements, believed that the government guidance, the legal framework, moral concepts, protection of intellectual property rights have a profound impact on the transformation of scientific and technological achievements, and put forward the recommendations on the legal system.[7],[8]

Hui Wang (2015) in the market survey found, in the process of transformation of scientific and technological achievements, the existence of the relevant intermediary agencies, market order confusion if failed to effectively monitor, is bad for the success of the transformation of scientific and technological achievements.[9]

Jiali Lin (2012),Songfu Lu(2014), after studying the research of university technology transfer model and the empirical analysis pointed that in the technology transformation of the research university, there exist such as lack of funding, technology transfer mode is not perfect, platform sharing problems such as wasting resources and so on. Jian-kun put forward a new concept of research university innovation ability to transfer and believe innovation transfer is a key process in our current country research university. [10],[11]

Jie Dong and Fujie Huang (2012) found that, not value in scientific research team construction in colleges and universities, the inadequacy of ability of scientific research personnel has a very important influence on the transformation of scientific and technological achievements.[12]

Zelong Peng(2015),Shunen Wu(2015) found in the transformation of scientific and technological achievements of colleges and universities, the consciousness is not strong, the market is a lack of enough knowledge, the chasm between research and market, and so on. They are seriously affected the transformation of scientific and technological achievements.[13],[14]

Solutions. There are a lot of measures about promoting transformation of scientific and technological achievements, including our incubator, productivity center, science and technology belong to some measures of the transformation of scientific and technological achievements. At present, our country promotes the local scientific and technological achievements transformation and corresponding measures.

Zhejiang province, new technology industry combined with the high school. Gong Jianli scholars use "jiaxing model", analyzed the impact of technology innovation in colleges and universities from regional factors. Research showed that the rapid development of the regional economy can drive the technological innovation in colleges and universities, colleges and technical innovation can also accelerate regional industrial structure adjustment and upgrading, both exist interdependent relationship.

Beijing innovative the integration between the university and the industry. Beijing university explored the application technology study of science and technology, the industrialization of new technology development - new technology for the integration of production, innovation alliance, implement engineering scientific research to the successful transformation of iron and steel enterprises. Tsinghua University implements the core "technology import, digestion, absorption and re-innovation, form a complete set of technology integration, industrialization, urban international market", effectively promote the substantial cooperation in the field of security technology between

China and Russia, set up a solid bridge to the world for enterprises.

Shanghai adopted the policy of the combination of innovative and operability. Shanghai jiaotong university, from the perspective of the construction of the national standard, joint research digital TV core technology. Currently with independent intellectual property rights of digital TV business system solutions have available in the country 10, 40 rooms. In "article 18" policy guidance, Shanghai not only increased the new content, make policy have quality, but regulate the amount, this has a very strong practicality.

Colleges and universities actively cooperate with enterprises in Hunan province. Central South university actively come out of school to carry out the new production with more than 30 large enterprises at home and abroad, set up joint research institutions, such as "China joint laboratory", jointly promote China’s aluminum industry technology upgrades.

Hebei construction characteristic and the advantage of regional innovation system. Hebei agricultural university walks more than 20 years "taihang road", combines the grain productive technology engineering research, helps to build a new socialist countryside.

Xi an in recent years, on the transformation of scientific and technological achievements, made an active exploration, formed a "talent + technology + capital + service" a whole thinking pattern of industrialization. Xi ‘an academy completed major national scientific research task, at the same time, faced the main battleground of the national economy. It made outstanding contribution the in the process of product upgrading, provided key technical support for the enterprise, lead the transformation of scientific and technological achievements. Such as introduced more than 30 foreign high-end entrepreneurial teams, hatched core photoelectric, formed the photons information, photon manufacturing, biological photon three disciplines and industry layout.

Review on the Research Status At Home and Abroad

For western countries, the enterprise can be market-oriented; it doesn’t need the government’s intervention. So, transformation of scientific and technological achievements in western countries is based on the weak government, weak management institutions. The government can only manage universities and research institutions but cannot intervene in the market enterprises, in the transformation of scientific and technological achievements in many countries abroad. Such as the United States federal technology transfer method, the main limit in commercialization, transformation and application. He can only manage the university scientific research institution directly, but cannot intervene market companies. Under the framework of the EU, the knowledge from the source of scientific and technological progress is mentioned, so we only talk about knowledge diffusion and technology application. The foothold about the transformation of scientific and technological achievements abroad is in the market environment. They research the process of transformation of scientific and technological achievements from the university to other organizations. Scholars focus on empirical research and a large number of literature, they have a very interest in the transformation of scientific and technological achievements.

However transformation of scientific and technological achievements in China is oriented government. Domestic research on transformation of scientific and technological achievements is mainly concentrated in opinion and experience summary, mainly from the present situation of the transformation of scientific and technological achievements. The influence factors such as surface problem can’t enough analysis on the data of the empirical analysis and the transformation of scientific and technological achievements of the real-time, dynamic research is weak. Besides, the range in the study of transformation of scientific and technological achievements in China is wide, it’s not been able to research on the concrete in the transformation of scientific and technological achievements. Throughout these research results we will be found that there are three problems: The one is the research of university of science and technology achievement transformation ability most from the macroscopic angle, it lacks the geographical characteristics of universities and institutes of its own factors and characteristics. Because different regions, different environments, but the same measures may produce the opposite results; the tow is in the process of transformation of scientific and technological achievements, the influence factors of the specific research have oneness and

limitations, lack of the systematic study of relevant factors in the process of transformation. The three is some studies is the pure theoretical qualitative research, lack of support on concrete data and case and lack of quantitative analysis in the process of transformation of scientific and technological achievements. Therefore, our research has a lot of space.

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