

# Technology Introduction, Absorptive Capacity and Host Country's Technical Progress

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**Abstract.** Technology introduction can promote technology progress and innovation ability of host country enterprises. By import, FDI and purchasing foreign technology, enterprises can achieve the technological upgrading and productivity improvement. However, Technology introduction can also lead to the dependence of enterprises on foreign technology. In the process of technology introduction, we must constantly improve learning ability and technology absorptive capacity, in order to promote the transformation from factor driving to innovation driven in Chinese enterprises.

## Introduction

Technology introduction has been regarded as an important way for backward countries to acquire technological knowledge spillovers from developed countries and upgrading technical level. In 2016, the expenditure for acquisition of foreign technology of industrial enterprises above designated size was 47.54 billion Yuan. Technology introduction can promote technological improvement and innovation capability of host country enterprises by importing high-end equipment, FDI and purchasing technology. However, large-scale technology introduction can also easily reduce the motivation of independent innovation of enterprises, lead to the dependence of enterprises on foreign technology, and fall into the strange circle of "introduction---backward---re-introduction---backward again". Only in the process of technology introduction, can we continuously enhance the absorptive capacity and promote the transformation from factor driven to innovation driven in China's industrial enterprises.

## Literature Review

The current research has not yet formed a unified opinion about the relationship between technology introduction and independent innovation, and the different empirical studies have also concluded the difference of the conclusion. Jaymin Lee (1996) uses the two stage method to study the impact of technology import and R&D on Korean manufacturing enterprises.[1]It is found that the technology import of Korea has a substitution effect on the R&D investment of manufacturing enterprises. Aradhna Aggarwal (2000) studies the relationship between technology import and R&D in India's manufacturing enterprises. [2] It has been found that import technology plays a very important role in economic efficiency because it fills the gap with the efficiency of its own technology. Kexin Bi, Zhaojun Yang and Mingye Ai (2012) thinks that foreign technology import has a positive impact on China's manufacturing technology innovation output. [3]

Some papers also discussed the mechanism and channel of technology introduction on independent innovation. Huixiong Qian (2011) regards that technology introduction will lead to production effect, learning effect and diffusion effect. When the diffusion effect is greater than the sum of production effect and learning effect, technology introduction can promote independent innovation. On the contrary, the introduction of technology inhibits independent innovation. [4] Zhongli Liu and Pingchuan Huang (2011) believes that the import of technology can improve the ability of enterprise technology innovation by three ways, such as the domestic threshold effect, the scale effect of knowledge and the substitution effect on domestic R&D. [5]Xuan Tang (2016)

studied the influence of different ways of technology introduction on different levels of independent innovation capability. [6]From the perspective of heterogeneous absorptive capacity, Liping Xiao & Danyang Xie (2016) investigates the nonlinear influence and innovation catching up effect of foreign technology import on its new product innovation growth. From the perspective of absorptive capacity, taking the industrial enterprises above designated size in China as an example, this paper analyzes the relationship between technology import and technical progress. [7]

### **The Promotion Mechanism of Different Technology Import Modes to Host Country's Technical Progress**

International trade, foreign direct investment and technology transfer are the three main ways of international technology transfer and diffusion. The influence mechanism of different technology introduction modes on the technical progress of host countries is different.

#### **Technology Spillover of Import**

International trade is the main carrier of materialized technical progress. The import of intermediate products and capital goods promotes the technological level of importing countries mainly through two ways, namely, demonstration effect and competition effect. First, imports bring opportunities for importing countries to imitate advanced technology. Secondly, in order to maintain or increase market share, the importing enterprises have to increase their R & D investment in order to improve the technological level of the enterprises, as the import intermediate products and capital goods bring competitive pressure to the importing countries to produce similar products.

#### **Technology Spillover of FDI**

Besides demonstration effect and competition effect, FDI also has training effect and human capital flow effect. While transferring technology to host country enterprises, MNCs often undertake technical training and technical guidance tasks, including solving specific technical problems, sending technical experts or instructors, and training the personnel of technical and quality management departments. When foreign enterprises train skilled workers and managers, the know-how will be transferred with them, and the skills will be further enhanced with the transnational flow of labor or inter-sectional mobility.

#### **Purchasing Foreign Technology**

Technology licensing and transfer is the most direct way of international technology diffusion. In the learning, absorption and reverse engineering of the imported technology, the technical R & D personnel are trained, the R&D ability is accumulated, the technical ability is promoted, and the sustainable innovation is finally realized.

### **Absorptive Capacity and the Upgrading of the Host Country's Technical Capacity**

The absorptive capacity was first proposed by Cohen and Levinthal (1990), which is used to measure the ability of an enterprise to recognize the value of new external technological knowledge and information and to commercialize it effectively. The introduction of technology is a learning process, and the implementation of every new technology requires a lot of tacit knowledge. The tacit knowledge is difficult to fully explain through technical manuals, and can only be gradually grasped and accumulated through production practice. If the learning ability of the importing countries is low due to the lack of technology and human capital, the introduction of technology will not only be difficult to generate technological spillovers, but also impede the upgrading of innovation capability.

Based on the data of 2011-2016 years' yearbook of China's science and technology statistics, this paper analyzes the scientific and technological activities, absorptive capacity and technological innovation capacity of industrial enterprises above designated size in China (shown in table1).

### **Expenditure for Assimilation of Technology**

The more input of digestion and absorption, the better understanding, learning and mastering new foreign technology, which is the most direct approximation of the technological absorptive capacity, and also the narrowest absorption capacity. The ratio of technology import to assimilation is an important index to measure the industry's learning of imported technology and its re-innovation capability. In recent years, the expenditure for assimilation of technology of industrial enterprises above designated size has increased rapidly, and the proportion of digestion and absorption expenditure has increased gradually. In 2016, the ratio reached 0.22, but the absorptive capacity of our country is still very low from the absolute level. In the period of technology introduction, the ratio of Japan is about 7, and the ratio of Korea is about 5. If the "redesign" and "two development" of the imported technology are lacking, it will not only affect the localization process of foreign technology, but also affect the ability of domestic manufacturing enterprises to catch up with technology, and seriously slow down the level of independent research and development of our manufacturing industry and the improvement of the basic ability of independent innovation.

### **Expenditure for Technical Renovation**

The more expenditure on technological renovation, the more likely to make breakthroughs and innovations on the basis of existing technology. This is a relatively broad absorption capability, which will bring about the improvement of the enterprise's ability to imitate and innovate. As is shown in Table 1, China's technological transformation expenditure increased year by year from 2011 to 2016. In 2016, the expenditure for Technical Renovation of industrial enterprises above designated size in China was 301.66 billion Yuan.

### **Science and Technology Personnel**

The improvement of independent innovation depends on a series of factors, such as technology introduction, learning by doing, independent R&D. All of which are inseparable from the skill level and learning ability of the labor force. Although China has a large number of innovative talents, but the supply of scientific and technological personnel is still inadequate, especially high level scientific research personnel, high skilled personnel and complex talents are not enough. Secondly, there are great differences in the structure of employment skills among the internal subdivision industry of manufacturing industry. The traditional low value-added and simple processing and manufacturing industry has a relatively low skill labor force. In addition, the lack of R&D institutions also leads to the loss of scientific and technological talents. Only less than 20% of the industrial enterprises in China have their own R & D institutions, which leads to the lack of technical guarantee and hi-tech talents, thus weakening the independent innovation ability of the enterprises.

### **R & D Input and Innovation Ability**

Technological innovation is a process of application, integration of internal and external technological knowledge, and the creation of new technological knowledge. R&D activities can not only produce new knowledge and products with commercial value, but also improve the ability to digest, absorb and use the existing knowledge. The technological capability of the enterprise can be promoted in the direction of specific technical progress. In recent years, the number of patent applications and new products and the sales revenue of new products increased year by year.

According to the experience of developed countries, it is necessary for a country to have the capacity for scientific research and independent innovation when the investment intensity of R&D (The ratio of internal expenditure to R&D and GDP) is more than 2%. In recent years, the intensity of R&D in China has gradually increased. However, there is still a big gap compared with the developed countries. In 2015, the intensity of R&D investment in Korea, Japan, Sweden and Austria was over 3%, but the ratio in China was only 2.06%. At the same time, the source structure and regional structure of R&D investment in China are not reasonable. The R&D funds mainly come from the internal expenditure of scientific research funds in the enterprises, and the intensity

of R&D investment in the eastern region is far higher than that in the central and Western Regions. In 2016, less than 30% of China's industrial enterprises above designated size had R&D activities, which means that a large number of enterprises in China still do not carry out R&D activities and have no independent intellectual property rights.

Table 1. Statistical Data on Science and Technology Activities of Industrial Enterprises above Designated Size

	(100 million yuan)					
	2011	2012	2013	2014	2015	2016
Percentage of Enterprises Having R&D Activities to Total Number of Enterprises(%)	11.5	13.7	14.8	16.9	19.2	23.0
Expenditure on R&D Projects	5993.8	7200.6	8318.4	9254.3	10013.9	10944.7
Expenditure for Acquisition of Foreign Technology	449.0	393.9	393.9	387.5	414.1	475.4
Expenditure for Assimilation of Technology	202.2	156.8	150.6	143.2	108.4	109.2
Expenditure for Technical Renovation	4293.7	4161.8	4072.1	3798.0	3147.6	3016.6
R&D Personnel	2546782	3051455	3375912	3632627	3645948	3867344
Patent Applications(piece)	386075	489945	560918	630561	638513	715397
Number of New products(unit)	266232	323448	358287	375863	326286	391872
Sales Revenue of New Products	100583	110530	128461	142895	150856	174604

Source: China Science and Technology Statistics Yearbook (Corresponding year)

### Conclusions and Policy Recommendations

Under the background of economic globalization, we should increase investment in independent R&D, and give full play to the role of external technology, so as to integrate and balance all kinds of technological channels. In the process of technology introduction, we should constantly improve the learning ability and technology absorptive capacities, and match with the labor skill structure, optimize the staffing of scientific and technological personnel, improve the training and introduction mechanism of scientific and technological talents, finally develop their own independent innovation system of technology. In short, we must give full play to the role of technology import in promoting innovation growth, and truly transform from technology dependence to independent innovation.

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