Research on the Development Path of Science & Technology Services to Drive Industrial Transformation and Upgrading

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Abstract. In the trend of the new economy, Science & Technology Services (S&T services) have played an important role in the course of innovation and entrepreneurship activity. This paper describes the function orientation of science & technology services, and research the interaction between S&T services and tertiary industrial sectors. The path of interaction demonstrates in the following four aspects: supporting agricultural modernization, promoting traditional industry transformation, fostering new industries and accelerating modern high-end services. Using input-output model, this paper examines interactive effects between S&T services and tertiary industrial sectors. In addition, it also makes suggestions on driving industrial transformation and upgrading by promoting the development of Science & Technology Services.

1. Introduction

At present, China's economy has ranked the second in the world and become a real manufacturing power. However, our industrialization process is facing a series of severe challenges, such as the disappearance of population dividends, the accumulation of unreasonable structure contradictions, the bottleneck ecological constraints, and the long-term "low-end and locked-in" of the global value chain. How to promote industrial transformation and upgrading is not only a practical problem, but also the difficulty and focus of policy consultation and academic research.

The main reason for the insufficiency of industrial transformation and upgrading in China is that the service-oriented level of structure is not enough. Especially, S&T service, which is as an carrier of technology and knowledge, have not effectively supported on technology and economy. Under the rise of service economy, the development of "China Service" has been a necessary intermediate link transferring from "Made in China" to "Created in China". In the future the large-scale and systematic development of S&T services is the inherent requirement for the realization of industrial transformation and upgrading. Then, In the new economy, can S&T services promote industrial transformation and upgrading, and what is its specific role path? How much does the penetration and impact capacity of S&T services affect on the three sectors of the national economy?

2. Literature review

With the rise of service economy, the function and role of S&T services in promoting innovation and entrepreneurship have gradually emerged. Muller[1], Antonietti[2], Amara[3] have respectively researched the function, development mode and influencing factors about S&T services. In recent years, the relationship between S&T services and economic growth have also attracted much attentions. Antonietti used micro-geographic data and non-parametric estimation method to find that there is obvious synergistic positioning characteristics between S&T services and manufacturing industry in metropolitan areas. [4]Based on panel data of the four largest European countries from 1995 to 2005, Ciriaci found that S&T services directly and indirectly promote product production and technological innovation in manufacturing industry through knowledge transfer.[5] As an emerging industry, S&T services play an important role in the national innovation system in the new economy,

[6]However, studies mostly focus on the function and role of S&T services from the micro-level perspective. There is a lack of research on the relationship between S&T services and economic sectors, and does not address the industrial transformation and upgrading issues with concern of developing countries.

Throughout the relevant research results, the view that S&T services can promote industrial transformation and upgrading has been generally accepted, and empirical researches focus more on the interaction between S&T services and manufacturing industry, but it lacks the theoretical elaboration and empirical investigation of the interaction, especially lack of the test of interaction effect within sub-industries.

3. Theory and Interaction Path

Under the trend of service economy, S&T services is the link between to promote traditional manufacturing industry and to modern service industry. There are four interaction path to demonstrate S&T services promote industrial transformation and upgrading, which are supporting agricultural modernization, promoting traditional industry transformation, fostering new industries and accelerating modern high-end services.

3.1 Supporting agricultural modernization

The development of scientific and technological services to support agricultural modernization is mainly manifested in three aspects: upgrading the level of agricultural R&D, promoting the integration of business forms and improving the agricultural information service system. Improving the level of agricultural R&D is a key element. The fundamental reason for Israel's strong international competitiveness in agriculture lies in the fact that high-intensity investment in agricultural scientific research fundamentally changes the function of agricultural production, improves the efficiency of production factors such as land, labor and water, and enhances the competitive advantage of Israel's agriculture in international trade.

3.2 Promoting traditional industry transformation

Faced with the dual constraints of rising labor costs and strict environmental protection regulations, the S&T services promote technological innovation and transformation and upgrading of low- and medium-tech manufacturing enterprises through industrial design, technology transfer and strategic consulting. Industrial design service is an important support for the transformation of traditional manufacturing industry.

3.3 Fostering new industries

In the process of industrial structure evolution, the essence of emerging industries is the result of the integration of industrial chain and innovation chain. The interactive development of technology service industry and high-tech manufacturing industry is not only reflected in the technical support of technology services to high-tech industries. It is also reflected in the business innovation and business model innovation needed to meet the needs of the development of medium and high technology manufacturing. At present, there are three types of technology, such as evolving emerging industries, convergent emerging industries and incubating emerging industries, in which the technology service industry and high-tech industries are mutually integrated.

3.4 Accelerating modern high-end services.

The development of modern service industry relies on cities, and the process of urbanization is also the process of service industry evolution. The level of service development, especially the level of producer services, is the important symbol to measure the regional role of cities and the international influence of cities. From the international experience, high-end service industry leads the world's cities, such as London, New York, Paris and Tokyo.

In general, if the agricultural and low-tech intensive manufacturing industry is summed up as a "traditional industry", conversely, the high-tech intensive manufacturing industry is summed up as "emerging industry". Then, the role of the S&T service industry in promoting industrial transformation and upgrading can be briefly summarized as "promoting traditional industry transformation" and "emerging industry upgrading". On the one hand, technology transfer to agriculture and traditional manufacturing through technology transfer services, achieve the integration of traditional industries and modern S&T services; on the other hand, mainly through research and development services promote advanced manufacturing. The path of the S&T services to promote industrial transformation and upgrading is shown in Figure 1.
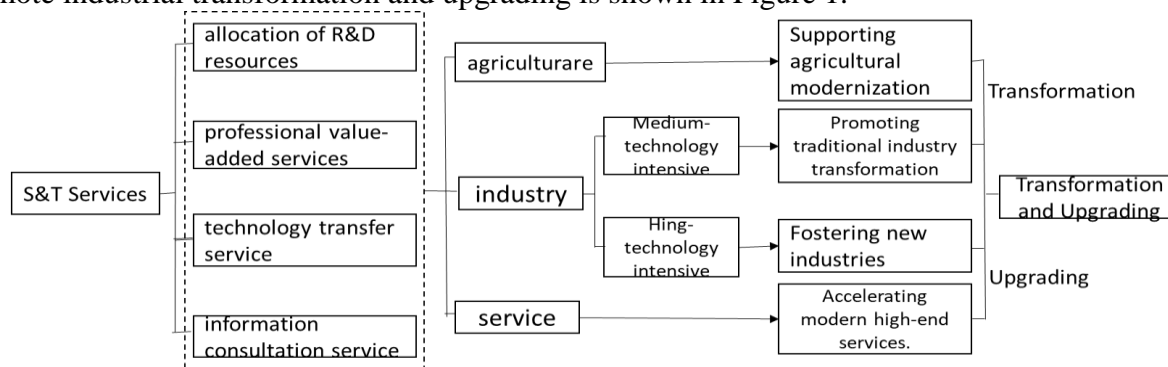

Figure1 the path of S&T services to promote industrial transformation and upgrading

4. Methodology and Results

4.1 Data and Methodology

In order to analyze the interaction effect between S&T services and the three industries of national economy in China, this paper divides the S&T service industry from the latest national statistical service classification (2015) and related academic research results released by the National Bureau of Statistics. "S&T Innovation and Innovation", "Professional Technical Service" and "S&T Information Service", and data were merged and processed from the input and output tables of 2002, 2007 and 2012 and the input and output extension tables of 2005 and 2010.

The input and output tables of the industrial sector are consolidated into : the first agriculture industry, the second industry, S&T services, and the tertiary industry that excludes S&T services. In the industrial sector, the input and output tables of the 4×4 department are obtained. The 4×4 department input-output table can comprehensively reflect the overall relationship between S&T services and the three industries about the national economy, and can clearly reveal the extent of the impact of S&T services on the three industries of the national economy.

4.2 Results

The direct consumption coefficient of the three industries of the national economy to S&T services is low, indicating that the current three industries are less dependent on S&T service industry, and the direct effect of the technology service industry on economic growth and industrial restructuring is not obvious. As shown in Table 1, the average consumption coefficient of the primary industry, the secondary industry and the tertiary industry that excludes the technology service industry from 2002 to 2012 is 0.0088, 0.0138 and 0.0161 respectively for the technology service industry. The direct investment is slightly higher than that of the secondary industry, indicating that the effect of the direct investment of the technology service industry in the current stage of China's economic development is not obvious.

Table 1 Direct consumption coefficient between science and technology service industry and tertiary industry

	Year	agriculture	industry	tertiary that excludes S&T.	S&T services
agriculture	2002	0.1622	0.0534	0.0176	0.0020
	2005	0.1568	0.0516	0.0184	0.0042
	2007	0.1407	0.0431	0.0141	0.0036
	2010	0.1330	0.0461	0.0147	0.0054
	2012	0.1378	0.0454	0.0109	0.0052
	average	0.1461	0.0479	0.0151	0.0041
industry	2002	0.1764	0.5280	0.2448	0.2955
	2005	0.1872	0.5738	0.2809	0.3491
	2007	0.2098	0.6316	0.2515	0.2407
	2010	0.2176	0.6277	0.2336	0.2498
	2012	0.2265	0.6134	0.1876	0.2727
	average	0.2035	0.5949	0.2397	0.2816
tertiary that excludes S&T.	2002	0.0732	0.1137	0.1890	0.1126
	2005	0.0619	0.1079	0.1822	0.1499
	2007	0.0520	0.0813	0.1887	0.1449
	2010	0.0522	0.0917	0.1837	0.1875
	2012	0.0434	0.0973	0.2370	0.1678
	average	0.0565	0.0984	0.1961	0.1525
S&T services	2002	0.0061	0.0158	0.0197	0.0296
	2005	0.0076	0.0147	0.0216	0.0654
	2007	0.0113	0.0111	0.0138	0.0423
	2010	0.0124	0.0128	0.0121	0.0557
	2012	0.0068	0.0145	0.0133	0.1349
	average	0.0088	0.0138	0.0161	0.0656

Low-tech industries and high-tech industries are directly dependent on S&T services. As shown in Table 2, the direct consumption coefficient of S&T services in different technology-intensive manufacturing industries is better. The average values which the high-tech industry and the high-tech industry affect S&T services from 2002 to 2012 are respectively 0.0167, 0.0103, 0.0140 and 0.0153. The low-tech industry has the highest dependence on S&T services, followed by high-tech manufacturing and medium-high-tech manufacturing.

Table 2 Direct consumption coefficients of S&T services with different tech-intensive

	Year	Low-tech intensive	Mediumlow-tech intensive	Mediumhigh-tech intensive	high-tech intensive	S&T services
Low-tech intensive	2002	0.1826	0.0797	0.0385	0.0494	0.0634
	2005	0.1971	0.1014	0.0460	0.0305	0.0881
	2007	0.2710	0.0983	0.0558	0.0458	0.0742
	2010	0.2569	0.0919	0.0496	0.0332	0.0590
	2012	0.2534	0.0844	0.0349	0.0421	0.0469
	average	0.2322	0.0912	0.0450	0.0402	0.0663
Midiumlow-tech intensive	2002	0.2044	0.4442	0.2809	0.1421	0.0287
	2005	0.2302	0.4733	0.3257	0.1690	0.0426
	2007	0.2248	0.5304	0.3072	0.1331	0.0348
	2010	0.2263	0.5278	0.2975	0.1493	0.0472
	2012	0.2369	0.5547	0.2936	0.1497	0.0710
	average	0.2245	0.5061	0.3010	0.1486	0.0449
Mediumhigh-tech intensive	2002	0.0432	0.0344	0.2649	0.0657	0.0891
	2005	0.0375	0.0324	0.2582	0.0984	0.1119
	2007	0.0416	0.0423	0.3167	0.0406	0.0732
	2010	0.0402	0.0432	0.3259	0.0495	0.0765
	2012	0.0249	0.0148	0.2802	0.0556	0.0524
	average	0.0375	0.0334	0.2892	0.0620	0.0806
High-tech intensive	2002	0.0130	0.0091	0.0272	0.3603	0.1144
	2005	0.0085	0.0050	0.0202	0.4160	0.1065
	2007	0.0082	0.0014	0.0300	0.4730	0.0585
	2010	0.0049	0.0036	0.0344	0.4933	0.0670
	2012	0.0079	0.0141	0.0738	0.3957	0.1024
	average	0.0085	0.0067	0.0371	0.4276	0.0898
S&T services	2002	0.0208	0.0117	0.0151	0.0101	0.0296
	2005	0.0174	0.0120	0.0164	0.0110	0.0654
	2007	0.0120	0.0094	0.0104	0.0162	0.0423
	2010	0.0137	0.0103	0.0132	0.0196	0.0557
	2012	0.0194	0.0078	0.0151	0.0196	0.1349
	average	0.0167	0.0103	0.0140	0.0153	0.0656

5. Discussion and Conclusion

This paper finds that the interaction and effect of interactive demand are manifested in three aspects:
1. The interaction between S&T services and the three industries, the direct dependence of S&T services on other industries of the national economy is greater than its of other industries on S&T services, and the direct dependence of the technology service on the secondary industry is the best.

2. In the interaction process, the interaction demand between S&T services and high-tech industry is obvious. Further analysis shows that the growth of high-tech industry pays more attention to the demand for R&D services, while the transformation and upgrading of low-tech industries have the demand for technology diffusion and application promotion services.

3. The interactive demand effect between S&T services and other producer services is not obvious. It may be possible reason that the role of S&T service industry in producer services is not fully played. It may also be reason that the transformation and upgrading of service economy in the initial stage is still dominated by traditional producer services, such as transportation and commerce, but the support of S&T innovation services for the transformation and upgrading of industries is still limited.

Acknowledgement

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