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The Mechanism and Empirical Test on the Effect of Technological Innovation on International Service Outsourcing in China

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Abstract: Technological innovation can promote the growth of international service outsourcing in China by advancing enterprise ability to undertake international service outsourcing, human resource quality, upgrading of international service outsourcing industry and base building of international service outsourcing. Based on the relative data from 10 areas where the international service outsourcing is developed best in China, this article builds the regression model to study the effect of technological innovation on international service outsourcing. The result indicates that technological innovation can promote obviously the development of international service outsourcing. Some suggestion should be taken to accelerate the technology innovation ability of china, such as adding the input to technological innovation, encouraging talent engaged in the international service outsourcing industry, optimizing environment of technological innovation.

Key words：Technological Innovation, International Service Outsourcing, Mechanism of Effect, Regression Analysis

1. INTRODUCTION

The international service outsourcing is a tech-intensive industry. It is important for developing international service outsourcing to advance the regional technological innovation ability.

The relationship between international service outsourcing and technological development has become an important research field with the deepening of research on international service outsourcing. First, some people studied the effect of developing international service outsourcing on technological progress of undertaking country. Yu Meici (2008) and Zhang Wang (2010) discusses the technology spillover effects of international service outsourcing by developing a model of endogenous technical progress that increases varieties of intermediate inputs. Through the competitive equilibrium analysis, they drew the conclusion that the technological spillover derived from outsourcing exerts positive effects on the technology growth of the undertaking country [1] [2]. Second，some people researched the effect of international service outsourcing on the technological innovation ability of undertaking enterprise. Bartel(2008) considered that IT outsourcing would aggravate the conflict between contractees and contractors, which can block technological innovation[3]. But Ren Zhicheng(2012) and Chen Qingjiang(2012) resulted the contrary conclusion through the empirically studies which undertaking international software outsourcing gains technology spillover, and then the innovation ability of enterprise will be improved. [4][5]. Third，some people studied the influence of the technology level on the development of international service outsourcing. After theory analysis and empirical test, Miozzo(2001)，Zhu Shengyong （2009） found that technology was one of the factors of promoting the development of international service outsourcing [6] [7]. Finally, CUI Ping and DENG Ke-bin(2013) studied the interaction between service outsourcing and regional technology innovation. Using the non-balanced panel data of Chinese's 21 demonstration cities for service outsourcing from 2008-2011, it showed that service outsourcing will accelerate the improvement of regional technology innovation, while the improvement of regional technology innovation will also stimulate the development of service outsourcing[8].

According to the literates, it finds that a few scholars study the influence mechanism of technological

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innovation on the development of international service outsourcing, the qualitative analysis about which needs strengthened too.

2. THE MECHANISM OF TECHNOLOGICAL INNOVATION ADVANCING THE DEVELOPING OF INTERNATIONAL SERVICE OUTSOURCINGhe

2.1 Technological innovation advances the ability of undertaking international service outsourcing

The sustainability and ability of technological development are based on technological innovation. The relationship between them is that the higher of latter， the stronger of former. And the level of technological development directly affects the ability and quantity of international service outsourcing, especially business process outsourcing (BPO) and knowledge process outsourcing (KPO) which belong to tech-intensive services. Cost had been the most important factor for international service outsourcing, but now it has been replaced by the technological innovation of partner. For example, CEMEX, the biggest cement company of Mexico, ask its service outsourcing contractor to provide innovative products per year, especially including open its R&D centre, access to its new business result and providing real innovation for CEMEX. Ultimately， the agreement got by IBM at 2012 will not only decrease the cost，but also advance the innovative ability of CEMEX. It is innovation that makes CEMEX become the biggest cement company in the world.

2.2 Technological innovation advances the human resource quality of international service outsourcing

International service outsourcing, as an international and knowledge-intensive industry, requires highly specialized talent and its development demands sufficient high qualified technical talent. Human capital is not only an important carrier of technological innovation, but also an essential productive factor of international service outsourcing industry. The technical talents with basic technology, software technology and other technology related the industry is the key element in international service outsourcing, and the administers can communicate effectively with the clients which compounded basic technology of service outsourcing, quality of forecasting industry development and ability to manage modern enterprises. Enterprises, colleges and scientific research institutions occupy the main body of technological innovation, but it is the human resource who actually engaged in the R&D. The researchers advance themselves ability of technology and take control of achievements of their researches at the process of technological innovation.

2.3 Technological innovation advances industrial upgrading

The international service outsourcing industry is comprise of 3 forms which are information technology outsourcing (ITO), business process outsourcing (BPO) and knowledge process outsourcing (KPO). It is different of the technology level demanded in the forms. The technology level is highest in KPO and which is lowest in ITO. Technological innovation can improve the technology level of enterprise, so that the enterprises can undertake not only ITO but also BPO and KPO, such as Research & Development, Business and Technical Analysis, Learning Solutions, Animation & Design, Business & Market Research, Pharmaceuticals and Biotechnology, Medical Services, Writing & Content Development, Legal Services, Intellectual Property (IP) Research, Data Analytics, Network Management, Training & Consultancy.

2.4 Technological innovation advances base building

Scientific and Technological Innovation play a key role to keep sustainable competition of outsourcing enterprises. These enterprises have to frequently cooperate with other enterprises for the purpose of enhancing own innovation ability and acquiring others technology achievement. More and more outsourcing companies that build in or relocate industrial park have partly advanced the base building of international service

outsourcing.

3. THE EMIRICAL TEST OF THCHNOLOGICAL INNOVATION IMPACT OF REGIONAL INTERNATIONAL SERVICE OUTSOURCING DEVELOPMENT

3.1 Analytical framework

Besides technological innovation, there are many other factors influence the development of international service outsourcing such as cost of human resources, quality of human resources, infrastructure.

3.1.1 Cost of human resources

Cost of human resources is a major cost to be paid, especially in the design and development, technical services, software services, business services, and other modern service industries. For example in software development industry, 70% of the cost is human resources. Therefore, human resource cost for the development of service outsourcing is important very much. The large number of low-cost human resources can reduce the costs and promote the competitive advantage for the international service outsourcing enterprises. Cost of human resources has become a factor to influence the development of international service outsourcing capabilities.

3.1.2 Quality of human resources

The talent is a key element of international service outsourcing industry development for which is labor and knowledge intensive industry. The comparative advantages of enterprise undertaking international service outsourcing depends more on the quality of human resources. The high-quality professionals can create high-quality service, so the enterprises which have high-quality professionals are favored. One of the reasons of the international service outsourcing is better in eastern of China than other region is that there are more professionals in eastern of China.

3.1.3 Infrastructure

Developments of information technology not only make the separation of services production and consumption, but also significantly reduce the cost of providing service in long distance, so information technology can provide technical support for service outsourcing across time and space. Information technology determines the delivery capability of service outsourcing, and the higher of information technology, the stronger of the delivery capability of service outsourcing. In addition, developed communication facilities and fast network infrastructures are also directly affect the scale of outsourcing.

There are some other factors which affect the development of regional service outsourcing, such as the level of service and regional open. This topic only chooses the above 4 factors to analyze.

3.2 Selection of variables and data

3.2.1 Selection of variables

The scale of international service outsourcing: Measured by the sum of execution money of undertaking international service outsourcing, this is marked as ISO.

Technological innovation: This factor is difficult to be accurately measured, but it can be roughly measured by R&D investment level [9]. So this article uses R&D investment level as an index to measure technological innovation, which is marked as STI.

Cost of Human Resource: The talents of software development, program design and data processing are the main human resource depended in service outsourcing, especially in ITO. Considering that ITO still dominate the international service outsourcing of China, this article chooses the average wage in information transmission, computer services and software industry as index to measure cost of human resource, which is marked as WAG.

Quality of Human Resource: Since the level of education can manifest the labor quality, this article chooses

the number of students at colleges and universities as index to measure quality of human resource, which is marked as EDU.

Condition of infrastructure: Development of international service outsourcing needs a lot of infrastructure, and the support of the telecommunications industry is so important that this article choose income in telecom field as the index to measure infrastructure, which is marked as TEL.

3.2.2 Selection and Standard of Date

Considering the available of date, this article choose the best 10 provinces in developing service outsourcing to study, which consists of Jiangsu, Guangdong, Shanghai, Zhejiang, Beijing, Shandong, Liaoning, Chongqing, Sichuan, Tianjin. Date of ISO derives from Chinese Service Outsourcing Research Center and Department of Commerce (or Commerce Committee) of every province, date of STI, WAG, EDU derive from "China Statistical Yearbook" and date of TEL derives from ministry of industry and information technology. The data of this paper using contain from 2009 to 2011.

The unit of every index is different and the numerical gap is quite large, so the data should be standardized. The way of standardization is standard deviation. The normalized values are calculated as the following formula:

$$Y_{ij} = \frac{X_{ij} - \overline{X}}{S_j} \quad (i = 1, 2, \ldots, N;\ j = 1, 2, \ldots, M)。 \tag{1}$$

Y_{ij} is the normalized value of j indicators in i province,

X_{ij} is the original value of j indicators in i province,

N is the number of provinces;

M is the number of evaluating indicators;

$\overline{X}$ is the average value of j indicator in all province，the formula as:

$$\overline{X} = \sum_{i=1}^{N} X_{ij} / N \quad (i = 1, 2, \ldots, N;\ j = 1, 2, \ldots, M)。 \tag{2}$$

S_j is the standardized deviation of j indicator, formula as:

$$S_j = \sqrt{\sum_{i=1}^{N} (X_{ij} - \overline{X})^2 / (N-1)} \quad (i = 1, 2, \ldots, N;\ j = 1, 2, \ldots, M)。 \tag{3}$$

3.3 Building model

According to the analysis of influencing factors, this article builds a regression model to study the influence of technological innovation on international service outsourcing. Model as follows:

$$ISO = \alpha_0 + \alpha_1 STI + \alpha_2 WAG + \alpha_3 EDU + \alpha_4 TEL + \varepsilon \tag{4}$$

"+" presents positive correlation，

α_0、α_1、α_2、α_3、α_4 are coefficient,

ε is estimated residuals.

The paper use the stepwise Regression Method to analyze the effect of technological innovation, cost of human sources, quality of human resources and infrastructure on international service outsourcing with the model built. Since the improvement of technological innovation, the quality of human resources and infrastructure can promote the development of international service outsourcing, so the article sets positive value of the indicators. The article builds negative value of cost of human resources because the decline of cost of human resources can promote outsourcing.

3.4 Empirical test and results analysis

SPSS17.0 and stepwise regression analysis are used to study the effect; the estimated results are as follows:

$$ISO = (-1.529\ E-7) + 0.715\ STI + 0.366\ WAG \quad (5)$$

（0.000） （5.956） (3.052)

F=21.338

R^2=0.612

Adjusted R^2=0.584

$D.W. = 2.497$

The parameter in parenthesis is the significant coefficient (the value of t).

The significant level is 0.001.

The variance and VIF test show that there is no co linearity between the variables, Unequal Variances test also refuse heteroskedasticity, and the fitness and the value of D.W show that the models have better explanatory capacity. The adjusted R-squared figure achieves to 0.584, which shows the formula have a better fitness.

As can be seen from the model, technological innovation and cost human resources are chosen into the model through stepwise regression analysis, which shows that technological innovation and cost human resources have a significant impact on the development of regional international service outsourcing. Quality of human resources and infrastructure are released from model because they have no significant impact on the development of regional international service outsourcing.

Technological innovation plays a key role to advance regional international service outsourcing, so the region and enterprise have technological innovation ability can easily undertake and develop large-scale international service outsourcing. Technological innovation can improve R&D, technology and delivery capabilities of the undertaker, even can share innovations with contracting companies which can contribute to the technological progress of contracting enterprises. Technological innovation is paid more attention and R&D is invested in large quantities in Jiangsu, Guangdong, Shanghai, Zhejiang, Beijing, Shandong, Liaoning, Chongqing, Sichuan and Tianjin where the international service outsourcing develop very fast in China. In 2009-2011, the R&D investments in Jiangsu, Guangdong are so significantly higher than other provinces that the scale of international outsourcing services is also significantly greater than other regions.

The cost of human resources reducing can advance the development of regional international service outsourcing. The cost of human resources is the main components of the international service outsourcing, so the decreasing cost of human resources can reduce heavily the cost of the international service outsourcing. The decreasing cost of human resources can promote the price competitiveness of the undertaker.

The value of parameter shows that the scale of regional international service outsourcing will increase 0.715% if the regional technological innovation ability increases 1%; the scale of regional international service outsourcing will increase 0.366% if the cost of human resources decreases 1%. So the effect of technological innovation on international service outsourcing is more great than which of other factors.

4. CONCLUSION AND SUGGESTION

Technological innovation promotes the development of international service outsourcing by advancing the enterprises undertaking service outsourcing, quality of human resource, upgrading of international service outsourcing industry and building industry base. The empirical analysis on 10 developed international service outsourcing regions indicates that technological innovation can promote obviously the development of international service outsourcing. In order to improve the level of technological innovation, these measures should be taken.

4.1 Investment of technological innovation should be increased

The government should increase financial support for technological innovation. On the one hand, the government may directly give financial allocation to enterprises and research institutions which take part in technological innovation. And allotments adapt to the regional economy development and the requirement of regional technological innovation, and the capital support should keep steady growth. On the other hand, government may indirectly give financial support such as favorable credit, tax breaks and subsidies in other areas to technological innovation. Third, government may encourage international service outsourcing enterprises to participate in technology research and development activities by loans and taxes concession. At last， government may build technological innovation funds to collect money from financial institutions and community.

4.2 Talent should be encouraged to join the technological innovation

Some measures should be taken to make high-level talent to engage in technological innovation activities. The human resource worked in technological innovation should be equipped with advanced work conditions. The body of technological innovation should establish and improve the promotion and reward system, provide favorable living conditions. Each regional government should also be good at found talent and guide them join the technological innovation, foster technological innovation reserve talent then form a stable and sustained development of human resources for technological innovation.

4.3 Technological innovation environment should be optimize

First, the information environment in many regions of China is relatively poor because there are fewer broad band access ports of internet, lengths of long distance optical cable lines, and even without special international internet ports [10]. Telecommunication networks and the internet should be perfected, the specialized commercial network channels should be established, the reliable information platform should be build. Second, regional governments should provide a good industry environment for technological innovation by encouraging enterprises to develop CMM / CMMI certification, establishing technological innovation alliance with large software enterprise as leader, developing industries chain with software, communications and services. Third, the governments should perfect long-term planning, policies and measures. Governments should strengthen service, supervise and administration.

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