Study on the Influence of Information Technology on the Efficiency of Silk Road Economic Belt in Logistics Industry

-Taking the Five Provinces in Northwest China as an Example

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Abstract—In this article, we used the DEA-BCC model to evaluate the logistics efficiency of five northwestern provinces along the Silk Road Economic Belt. The result showed that in the five provinces, the average pure technical efficiency is 0.835, the scale efficiency is 0.714, and the comprehensive technical efficiency is 0.594. Then, we built the level of information development involving 3 first-level indicators, namely ICT infrastructure, ICT environment and ICT application, and 10 secondary indicators. Next, we evaluated the level of information development and ranked the logistics efficiency of the five provinces from high to low as follow: Xinjiang, Ningxia, Shaanxi, Qinghai and Gansu. Then based on the results form DEA model, we established Tobit regression model to evaluate the impact of information development level on logistics industry efficiency. And we found there is a positive correlation between the level of information development and the efficiency of logistics industry. In the last part of the article, we put forward that the five northwestern provinces should expand the scale of the logistics industry and accelerate the integration of the information technology and logistics industry to create the intelligent logistics.

Keywords—Information technology; Logistics industry efficiency; Silk Road Economic Belt

I. INTRODUCTION

Under the background of the Silk Road Economic Belt, the logistics industry has been described as an accelerator to promote economic development. As a basis for supporting economic and social development of strategic industries [1], it put forward higher requirements for information technology. The whole process of information technology throughout the logistics activities plays a supportive role to ensure the logistics activities to been seen as a "central nervous system"[2] Advance in information technology is an important driving force to promote the development of the logistics industry, and it could also improve the operational efficiency of the logistics industry better and faster. Eventually, it keeps sustainable competitive advantage logistics industry and promotes the healthy development of the logistics industry.

II. JOURNALS REVIEWED

At present, Gheorghe (2011) analyzed the informatization restructuring of the world economy and market, redefined the influence of informatization on logistics under the business model, and pointed out that the logistics enterprises which ignored informatization would eventually die out [3]. CHOY (2014) investigated 210 logistics enterprises in Hong Kong and the Pearl River delta, and analyzed the impact of information technology on the service quality and competitiveness of logistics enterprises by using the structural equation model [4]. Sorina (2015) have developed an agent-based model to simulate the effect of real-time information to test the impact of real-time information use on traffic conditions [5]. Based on the provincial panel data of 30 regions in China from 2005 to 2014, Xie Pengcheng (2017) explored the influence and spillover effects of technological innovation and information level on the development of commercial circulation industry. It was found that both technological innovation and improvement of technological level were conducive to the rapid development of the trade flow industry [6]. With the help of a Feder model, Wang Hengyu, Zhang Ying (2017) used China's statistical data from 2000 to 2014 to calculate the circulation department of information industry spillover effect. The empirical inspection found that the information industry development technology was very significant contribution to the efficiency of the circulation department [7].

At present, scholars' research has simple measurement indexes for information technology, which cannot reflect the real degree of current information development. Therefore, the impact on the logistics industry may be different. Based on the above, the research of this paper is carried out. First, the logistics efficiency of five provinces in northwest China from 2007 to 2016 was calculated by DEA model. Then, the index system was designed to calculate the informatization development level of the five provinces in northwest China from 2007 to 2016. Finally, Tobit model is used to calculate the influence of information technology on the efficiency of logistics industry in five provinces in northwest China.

III. THEORETICAL EXPLANATION - BASED ON NEOCLASSICAL ECONOMIC GROWTH MODEL

American economist Robert Solow proposed the famous neoclassical economic growth model in development economics in 1956. In this model, Solow introduced technological progress into the production function for the first time, believing that there was the possibility of technological progress changing the production function, and clearly pointed out that technological progress played an important role in economic growth. As one of the typical representatives of modern science and technology, information technology plays an increasingly important role. In the background of rapid development of information and "Internet plus", information technology, as another major energy source other than material, capital and manpower in various social and economic activities, is put into production and operation, which reduces labor cost. In addition to the traditional factors of production, in the process of increasing productivity, accelerating specialization of logistics and upgrading of structure, information technology is also the most important driving force and pillar, and becomes the endogenous driving force of economic growth. Therefore, the information technology investment in the efficiency of the logistics industry has a direct impact on growth.

IV. EMPIRICAL TEST

This paper uses Deap2.1 to analyze the data of input and output of logistics industry in the five provinces of northwest China.

TABLE I THE EFFICIENCY OF THE LOGISTICS INDUSTRY FROM 2007 TO 2016 IN THE FIVE NORTHWEST PROVINCES CHINA EVALUATION RESULTS

year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
crste	0.664	0.591	0.549	0.516	0.542	0.597	0.612	0.652	0.632	0.588
vrste	0.903	0.83	0.786	0.761	0.775	0.819	0.823	0.922	0.878	0.852
scale	0.728	0.727	0.729	0.709	0.71	0.732	0.727	0.697	0.705	0.672

Overall, the result showed that among of the five provinces, the average pure technical efficiency is 0.835, the scale efficiency is 0.714, and the comprehensive technical efficiency is 0.594. It can be seen that the low overall efficiency of logistics industry is caused by the low scale efficiency, which reflects the fact that the whole silk road economic belt is relatively backward [8].

V. BUILD A MODEL (TOBIT MODEL)

$$y_i^* = x_i\beta + \mu_i \qquad \mu_i \sim N(0\ \sigma^2$$

$$y_i = \begin{cases} y_i^* & if \quad y_i^* > 0 \\ 0 & if \quad y_i^* \le 0 \end{cases}$$

VI. CORE VARIABLES - THE LEVEL OF INFORMATION DEVELOPMENT

This paper is based on the characteristics of "One Belt And One Road" and the economic foundation of five provinces in northwest China, while referring to Yang Daoling, Li Xiangli (2018) [9]. This paper proposes an index system for evaluating the informatization development level of One Belt And One Road "core area".

TABLE II EVALUATION SYSTEM OF INFORMATION DEVELOPMENT LEVEL

First-level	Second-level	Weights
ITC application	Telephone penetration rate (including mobile phone) (Department / 100 persons)	10
	Mobile phone popularity (Ministry / hundred people)	10
	Internet penetration rate (%)	10
ITC environment	Coverage of Internet broadband access port (individual / person)	10
	Fixed toll telephone capacity coverage (Road end / person)	10
	Capacity coverage of local switch (door / person)	10
	Capacity coverage of mobile telephone switches (household / person)	10
ITC base	Per capita GDP (yuan / person)	10
	Enrollment rate of high education (average number of students per one hundred thousand population)	10
	Science and technology of per capita financial investment (yuan / person)	10

Referring to the international telecommunication union (itu) IDI index and the United Nations e-government development index, from the mean value of the information development index in the five provinces and autonomous regions of northwest China from 2007 to 2016, we can see that Xinjiang, Ningxia and Shaanxi belong to the high informatization development level, Qinghai belongs to the medium informatization development level and Gansu belongs to the low informatization development level.

VII. CONCLUSION

TABLE III   THE REGRESSION RESULT OF INFORMATIZATION DEVELOPMENT LEVEL TO COMPREHENSIVE EFFICIENCY OF LOGISTICS INDUSTRY

crste	Coef.	Std.Err.	t	P
ICT	1.314229	0.7301453	1.8	0.079
ECO	-6.677301	4.806033	-1.39	0.172
TRADE	-0.2807049	0.5871433	-0.48	0.635
FABRIC	3.007448	1.27811	2.35	0.023
TOWN	0.8634764	1.203122	0.72	0.477

The table shows the regression results can be seen that the level of development of information technology on the overall efficiency of the logistics industry is significant at the 10% level and the coefficient of regression results is 1.31. At the same time, the industrial structure is a significant positive effect of comprehensive efficiency of logistics industry, which can explain the development of the third industry especially the rapid development of the logistics industry can promote the overall efficiency of the logistics industry.

Policy suggestion

(1) Building logistics parks and expanding the logistics industry. In this era of logistics globalization, we can build logistics parks and put it into the "silk road economic belt" strategy actively, developing freight hub, production services, business services, port services and comprehensive service of logistics park, and give play to the demonstration and driving role of logistics park.

(2) The deep integration of information technology and logistics industry. In the "Internet plus" era, as the idea of a Shared economy deepens, the internal integration of various links in the logistics industry, the external integration of the upstream and downstream of the logistics industry chain, and the cross-border integration between the logistics industry and the Internet, finance and other industries can not only promote the rapid development of the logistics industry itself, but also promote the accelerated upgrading of the entire industrial chain.

(3) Building smart logistics quickly. Intelligent logistics is to obtain information in the circulation process so as to analyze information and make decisions, makes goods tracked and managed from the beginning and realizes information flow faster than material flow. We will accelerate the building of smart logistics in countries and regions along the One Belt And One Road line in order to accelerate the construction of One Belt And One Road.

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