

# 중국 물류 상장기업의 성과평가에 관한 연구

왕능봉\*, 심재연\*\*

중국 귀주성 천주담배물류유한회사 고급경제사, 세한대학교 경영학과 교수\*\*

## Research on Performance Evaluation of Listed Logistics Enterprises in China

Lingfeng Wang\*, Jae-Yeon Sim\*\*

Senior Economist, Quanzhou Tobacco Logistics Co., Ltd., \*  
Professor, Dept. Of Management, Sehan University\*\*

**요약** 최근 물류기업은 경제활동의 중요한 구성요소로 빠르게 발전해 왔으나 물류기업의 특수한 성과관리 방식으로 인해 성과평가에 문제가 대두되고 있다. 본 논문은 중국 내 19개 상장 물류기업의 경영성과를 분석하여 실적개선 전략을 제시하였다. 투입변수로는 운영비, 연구개발비, 인건비, 일반관리비를, 산출변수로는 영업이익과 순이익을 채택하였다. DEAP 2.1 소프트웨어를 사용하여 2016년부터 2021년까지 BBC 모델에 의해 DEA 효율성을 평가하였다. 연도별 경영실적을 분석한 결과 일부 상장 물류기업이 안정적이고 전향적인 성과 결과를 보이고 있었다.

**주제어** 상장물류기업, 성과평가, DEA방법, 투입변수, 산출변수

**Abstract** Logistics companies have rapidly developed as an important component of economic activities, but due to the special performance management method of logistics companies, problems in performance evaluation are emerging. This paper presented a strategy for improving performance by analyzing the management performance of 19 listed logistics companies in China. Operating expenses, R&D expenses, labor costs, and general management expenses were adopted as input variables, and operating profit and net profit were adopted as output variables. DEA efficiency was assessed by the BBC model from 2016 to 2021 using DEAP 2.1 software. As a result of analyzing the annual management performance, some listed logistics companies showed stable and forward-looking performance results.

**Key Words** Logistics Listed, Company Performance Evaluation, DEA Method, Input Variables, Output Variables

\* This Paper was supported by the Sehan University Fund in 2023.

Received 07 Mar 2023, Revised 11 Apr 2023

Accepted 14 Apr 2023

Corresponding Author: Jae-Yeon Sim  
(Sehan University)

Email: simjy@sehan.ac.kr

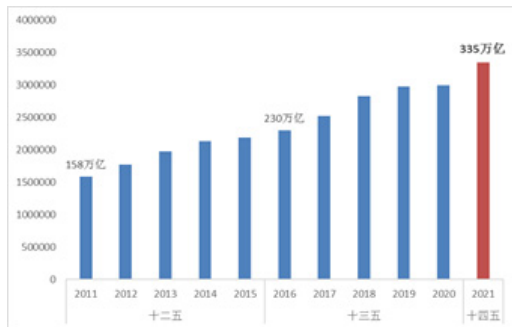
ISSN: 2466-1139(Print)

ISSN: 2714-013X(Online)

© Industrial Promotion Institute. All rights reserved. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## 1. Introduction

At present, as China's rapid economic development has developed from the past traditional mode to the modern logistics industry, logistics industry has become an important part of the national economy, and has become the basic industry of China's economic development [1]. From the current analysis, first of all, the reform and development of logistics enterprises is coming, forming a new development form based on the development of e-commerce [2]. Thirdly, with the development of China's informatization and the increase of mobile phones, the structure of Chinese logistics enterprises has also changed, and they are developing towards smart logistics. Finally, the proportion of the total social cost of logistics in GDP has decreased, and the continuous development of e-commerce has also created more opportunities for logistics enterprises [3].



〈Fig. 1〉 Total social logistics from 2011 to 2021 (Unit: 100 million yuan)

The proportion of social logistics in China is 14.5%, while that in the United States, Japan and Germany is less than 10%. Therefore, there is still a lot of room for progress in the future development of China's logistics industry [4]. With the promotion of China's "One Belt and One Road" policy, the development of the world economy and the promotion of e-commerce, the economic development mode of logistics industry is changing [5]. With the strengthening of international

cooperation, international logistics enterprises have also entered the Chinese market, which is also a great threat to the listed Chinese logistics enterprises whose operation and management level is not high [6]. This requires these Chinese listed logistics enterprises to focus on improving their own performance under the premise of ensuring operation. The purpose of this paper is to develop a set of evaluation system to effectively evaluate the operating efficiency of logistics enterprises, so as to improve the management efficiency of enterprises [7].

Many scholars have studied and analyzed the operation efficiency of logistics enterprises, and the evaluation methods are also different, but there is a common disadvantage that the evaluation system is relatively single [8]. Therefore, using scientific methods to compare will be more objective analysis of the logistics industry's operating efficiency level. Therefore, this paper selects data envelopment analysis (DEA) data envelopment analysis method to evaluate the performance of logistics enterprises, and puts forward a more feasible improvement method [9].

## 2. Review of Literature

Logistics enterprises have gradually become a pillar industry of national economic development, and the research on the performance of logistics enterprises has also emerged in an endless stream, which has attracted the attention of scholars inside and outside China [10]. The research on performance evaluation of logistics enterprises based on DEA method outside China is still more advanced than that of Chinese scholars, especially in logistics enterprises, the research methods are relatively rich and the research results are quite large. In 1980, Schlannar introduced DEA model to evaluate the efficiency of logistics companies for the first time, and he believed that DEA method could be used to evaluate the service efficiency of third-party logistics companies [11]. Omrani (2016) used DEA to

evaluate the efficiency of each link of the supply chain of Iranian industrial enterprises in 2008 and 2011 [12]. Marti (2017) used the method to calculate the comprehensive performance evaluation index DEA-LPI of logistics enterprises, and found that the performance of logistics enterprises was largely affected by the level of regional economic development [13]. Chang (2017) used the SBM-DEA model to explore the environmental performance of Chinese and South Korean transportation enterprises, and studied and analyzed the differences in the environmental performance of the two enterprises [14]. Amer (2018) evaluated the operational efficiency of the logistics industry and analyzed it by combining the DEA model with value factor and weight factor. Through the analysis, the influence degree of each input-output index on the operation efficiency is found, and the improvement suggestions are put forward according to the results [15].

In recent Chinese literature, Jing Qi (2017) took the financial performance of listed media companies as the research object, used the analytic hierarchy process to screen the financial indicators, and used the DEA method to evaluate the financial performance of listed media companies [16]. Chen Yan li and Wang Lei (2018) used DEA Malmquist index and Tobit model to evaluate the financial performance of northeast manufacturing companies and its influencing factors, and put forward suggestions for the business development of northeast manufacturing companies [17]. Li Tao and Liang Jing (2019) integrated DEA and RS rough set analysis to evaluate the performance level of listed agricultural companies with the integration of industry and finance, and the research results showed that the integration of industry and finance could improve the operating performance level of listed agricultural companies [18]. Zhan Rongfu and Huang Lijun (2020) used DEA method to measure the logistics efficiency of 9 cities and 2 districts in Guangdong-Hong Kong-Macao Greater Bay Area

from 2010 to 2016, and used ANN model to analyze the relevance and importance of the causes affecting the logistics efficiency [19]. Liu Gangqiao, Shi Jianhua, Li Ming (2021) adopted the non-parametric SE-SBM-DEA model to study the efficiency level of the logistics industry in Guangdong Province [20].

### 3. Research Design

#### 3.1 Brief introduction of DEA method

In 1978, A. Harnes, W. W. Cooper and E. Rodes, famous American operations research scientists, first proposed the method of DEA. DEA method is mainly used to evaluate the effectiveness of the things, Evaluate the optimal production purpose, DEA was more widely used, and the performance evaluation system of logistics industry also began to be used [21]. Scholars mostly analyze logistics enterprises, industries or regions as research objects [22]. Hokey (2006) used DEA to evaluate the efficiency of the logistics industry in the United States, and concluded that service performance and breadth had the greatest impact on the efficiency of the logistics industry [23].

#### 3.2 The BBC model

After analysis, this paper finally selects the sample data of BBC model for analysis and calculation [24], and the formula of BBC model is as follows:

$$\begin{cases} \min [\theta - \varepsilon(\hat{e}^T s^- + e^T s^+)] = V_D(\varepsilon) \\ s. t. \sum_{j=1}^n \lambda_j x_j + s^- \leq \theta x_0 \\ \sum_{j=1}^n \lambda_j y_j - s^+ \geq y_0 \\ \sum_{j=1}^n \lambda_j = 1 \\ \lambda_j \geq 0, j = 1, 2, \dots, n, s^+ \geq 0, s^- \geq 0 \end{cases} \quad (3-1)$$

as  $\hat{e}^T = (1, 1, \dots, 1) \in E_m, e^T = (1, 1, \dots, 1) \in E_0$ . In the next sentence, instead... When the optimal solution of the above equation is  $\lambda_0, \tilde{s}_0, s_0^+, \theta_0$ , There are: if  $\theta_0=1$ , Then the decision making unit jo Is if DEA is effective

(BCC), If you are satisfied  $\theta_0=1, s^-=0, s^+=0$  Time decision unit Is valid for DEA(BCC).

### 3.3 Selection of samples

<Table 3.1> Nineteen listed logistics enterprises in China

Code	Enterprise	Code	Enterprise
002352	Sfexpress Holdings	002930	Hongchuan Wisdom
002120	Yunda Shares	600179	Antong Holdings
002183	Eternal Asia Link	600233	Yto Express
002468	Shentong Express	002889	Oriental Jiasheng
002682	Longzhou Stock	603056	Deppon Shares
002769	Plutong	603967	China Innovation Logistics
600676	Delivery Of Shares	603128	Huamao Logistics
300013	Xinning Logistics	603223	Shares Of Hengtong
300240	Flying Power Radar	603569	Long Term Logistics
600125	Ironlong Logistics		

This data source: the tide of information network, <http://www.cninfo.com.cn/new/index> in 2022

I derive the following results from the research in this paper: First of all, I learned about the operating conditions and development of 19 listed logistics enterprises in China. Secondly, I establish evaluation criteria and evaluation indicators by designing models, to achieve a scientific and systematic evaluation system. Third, I further explain the performance level of logistics enterprises through the efficiency established by this model [25]. Fourth, I establish a DBA index data model to understand the operational efficiency of 19 listed logistics companies in China from 2016 to 2021. Fifth, I identify a number of problems and suggest ways to improve effectiveness.

### 3.4 Justification for input and output variables

When selecting sample logistics listed companies, the following requirements should be met:

First of all, the main business of the selected sample companies should be logistics-related business; Secondly, the convenience of data acquisition should

be taken into account, and the results should be selected from China's regular listed logistics companies. This paper selects 19 regular listed logistics enterprises in China as samples from Juchao Information Network in 2022.

#### 3.4.1 Input variable

Theoretically speaking, considering the limited factors such as the availability of enterprise data and the comparability of indicators, this paper refers to literature inside and outside China, On the basis of the characteristics of listed logistics enterprises, four different indicators are selected as input variables, which are operating cost, research and development cost, employee compensation and management cost [26].

#### 3.4.2 Output variable

Output indicators In terms of output, the most important output is various logistics services, such as transportation, warehousing, packaging and other logistics services [27]. Main business income Operating income and total profit are the output of listed logistics enterprises reflected in the financial statements of the company's annual report, so this paper chooses operating income and total profit as output indicators. It can be seen from the above that most research experts and scholars start from the three aspects of human, financial and material, and the input-output index analysis of this study.

<Table 3.2> Input and output indicator

The Method	Indicators of
Investment in	Operating costs
Investment in	Research and development expenses
Investment in	Compensation for employees
Investment in	General and administrative expenses
Output of goods	Total operating income
Output of goods	Total profit for the year

#### 4. Empirical Analysis

The DEAP2.1 software used in this paper obtains the efficiency evaluation results of BBC model DEA for 19 listed logistics enterprises in China from 2016 to 2021:

In 2016, all the five listed logistics enterprises are in a fully effective state. In 2017, the five listed logistics enterprises were all in a fully effective state. In 2018, there were 7 enterprises with effective operating efficiency. In 2019, all the five listed logistics enterprises are in a fully effective state. In 2020, all the 6 listed logistics enterprises are in a fully effective state. In 2021, all the 7 listed logistics enterprises are in a fully effective state. It shows a trend of "steady progress".

Table 4.1 shows the comprehensive technical efficiency of the DEA model for 19 listed companies in the logistics industry over the past six years. From the average value of these years, the comprehensive efficiency level shows a fluctuating trend, and the comprehensive efficiency level reaches the highest in 2020, indicating that 2020 is a good year for the development of China's listed logistics enterprises, but the comprehensive technical efficiency decreases in 2016, and the change of comprehensive technical efficiency is mainly due to the change of scale efficiency. It can be seen that in 2016, the scale efficiency of China's listed logistics enterprises changed greatly. The average value of the overall comprehensive technical efficiency in these six years is 0.917, and there are six enterprises below this level. The lowest is Xinning Logistics, which is only 0.684, while the highest is Tielong Logistics and Hongchuan Wisdom, which is 1. It can be seen that the average comprehensive technical efficiency value in these six years has a wide gap. For enterprises below the average value, they should strengthen the improvement of scale efficiency to improve the comprehensive technical efficiency.

(Table 4.1) Output from 2016 to 2021 (TE)

The Enterprise	2016	2017	2018	2019	2020	2021	Average value
SfExpresHolding	0.710	0.722	0.770	0.801	0.792	0.760	0.759
Yunda shares	0.906	0.936	1.000	1.000	0.925	0.888	0.942
Eternal Asia Link	0.943	0.907	1.000	1.000	1.000	1.000	0.975
Shentong Express	1.000	1.000	1.000	0.971	0.906	0.892	0.962
Longzhou Stock	0.742	0.884	0.958	0.941	0.752	0.998	0.879
Plutong	0.903	0.926	0.981	0.991	1.000	0.968	0.962
Xinning Logistics	0.678	0.702	0.670	0.552	1.000	0.501	0.684
Flyingpowerradar	0.671	0.762	0.813	0.870	0.844	0.894	0.809
IronLong Logistics	1.000	1.000	1.000	1.000	1.000	1.000	1.000
HongchuanWisdom	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Antong Holdings	1.000	1.000	1.000	0.751	1.000	1.000	0.959
Yto Express	0.924	0.906	0.921	0.996	0.928	0.953	0.938
Oriental Jiasheng	1.000	1.000	1.000	1.000	0.957	1.000	0.993
Deppon Shares	0.687	0.729	0.791	0.942	1.000	0.825	0.829
ChinaInnovation Logistics	1.000	1.000	0.992	1.000	1.000	1.000	0.999
Huamao Logistics	0.913	0.921	0.951	1.000	0.982	0.978	0.957
Hengtong Logistics	0.835	0.882	0.917	1.000	1.000	1.000	0.939
Long term logistics	0.953	0.932	0.956	0.942	0.912	0.904	0.933
Delivery of shares	0.817	0.908	0.926	0.971	0.890	0.887	0.900
Average value	0.878	0.901	0.929	0.933	0.941	0.918	0.917

Table 4.2 shows the changes in the pure technical efficiency of 19 listed companies in the logistics industry in the past six years, which is highly consistent with the changes in the comprehensive technical efficiency level from the data of each year. From the average of each year, it maintained an upward trend from 2016 to 2019, but declined after 2020. Since 2016, China's e-commerce has developed rapidly, and the development of listed logistics enterprises has had an impact in 2016. However, in 2019, due to the impact of COVID-19, the average pure technical efficiency of China's listed logistics enterprises still declined.

<Table 4.2> Output 2016–2021 (PTE)

The Enterprise	2016	2017	2018	2019	2020	2021	Average
SfExpressHolding	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Yunda shares	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Eternal Asia Link	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Shentong Express	1.000	1.000	1.000	0.981	0.952	1.000	0.989
Longzhou Stock	0.823	0.912	0.966	0.969	0.808	0.999	0.913
Plutong	0.919	0.944	0.981	0.996	1.000	1.000	0.973
Xinning Logistics	0.898	0.978	0.976	1.000	1.000	0.642	0.916
Flyingpowerradar	0.788	0.807	0.825	0.896	0.872	0.921	0.851
IronLong Logistics	1.000	1.000	1.000	1.000	1.000	1.000	1.000
HongchuanWisdom	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Antong Holdings	1.000	1.000	1.000	0.755	1.000	1.000	0.959
Yto Express	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Oriental Jiasheng	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Deppon Shares	0.947	1.000	0.944	0.987	1.000	1.000	0.980
ChinaInno vation Logistics	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Huamao Logistics	0.913	0.923	0.956	1.000	1.000	1.000	0.965
Hengtong Logistics	0.843	0.888	0.919	1.000	1.000	1.000	0.942
Long term logistics	0.953	1.000	0.958	0.961	0.935	0.910	0.953
Delivery of shares	0.910	0.944	0.934	0.979	0.919	0.905	0.932
Average value	0.947	0.968	0.972	0.975	0.973	0.967	0.967

Table 4.3 above shows the distribution of scale efficiency of 19 listed companies in six years. Moreover, scale efficiency is obtained from the quotient of comprehensive technical efficiency and pure technical efficiency, and is positively related to comprehensive technical efficiency and inversely related to pure technical efficiency. From 2016 to 2021, the number of companies with effective scale efficiency is 8, 6, efficiency of these 19 listed enterprises in the 8, 8, 8 and 7, respectively. The average scale logistics industry is 0.946, which still has some room for improvement. Among the 19 listed companies, three are below the average level, among which the highest is Tielong Logistics and Hongchuan Wisdom, which is

1. The lowest value is 0.749 for Xining Logistics, and the gap between the two is 0.251.

<Table 4.3> Output from 2016 to 2020 (SE)

The Enterprise	2016	2017	2018	2019	2020	2021	Average
SfExpress Holding	0.710	0.722	0.770	0.801	0.792	0.760	0.759
Yunda shares	0.906	0.936	1.000	1.000	0.925	0.888	0.942
Eternal Asia Link	0.943	0.907	1.000	1.000	1.000	1.000	0.975
Shentong Express	1.000	1.000	1.000	0.990	0.951	0.892	0.972
Longzhou Stock	0.901	0.969	0.992	0.972	0.930	0.999	0.960
Plutong	0.982	0.981	1.000	0.996	1.000	0.968	0.988
Xinning Logistics	0.756	0.718	0.687	0.552	1.000	0.781	0.749
Flyingpowerradar	0.852	0.944	0.986	0.971	0.967	0.971	0.948
IronLong Logistics	1.000	1.000	1.000	1.000	1.000	1.000	1.000
HongchuanWisdom	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Antong Holdings	1.000	1.000	1.000	0.995	1.000	1.000	0.999
Yto Express	0.924	0.906	0.921	0.996	0.928	0.953	0.938
Oriental Jiasheng	1.000	1.000	1.000	1.000	0.957	1.000	0.993
Deppon Shares	0.725	0.729	0.838	0.954	0.849	0.821	0.819
ChinaInno vation Logistics	1.000	1.000	0.992	1.000	1.000	1.000	0.999
Huamao Logistics	1.000	0.998	0.994	1.000	0.982	0.944	0.986
Hengtong Logistics	0.991	0.994	0.997	1.000	1.000	1.000	0.997
Long term logistics	1.000	0.932	0.998	0.981	0.976	0.992	0.980
Delivery of shares	0.898	0.962	0.992	0.992	0.969	0.981	0.965
Average value	0.926	0.931	0.956	0.958	0.959	0.945	0.946

## 5. Conclusion

Through the analysis of the operating efficiency level of the 19 listed logistics enterprises in China, it is found that Tielong Logistics and Hongchuan Wisdom have good indicators in the comprehensive efficiency, pure technical efficiency and scale efficiency of the 19 listed logistics enterprises in China from 2016 to 2021. As a result, the operating efficiency of some listed logistics enterprises does not reach base 1, so improvement should be strengthened in several

aspects [28].

(1) The organizational structure of internal logistics enterprises should be improved and personnel training should be strengthened.

Some listed logistics enterprises in China have not reached the production frontier level and are not close to the comprehensive efficiency base 1, which indicates that the operating cost of some listed logistics enterprises in China is a little high, and they should improve their earning ability by reducing the cost and increasing the rate. Attention should be paid to the training of professional and technical personnel and management personnel in enterprises to improve the performance and management ability of internal resources in logistics enterprises.

(2) Enterprise informatization and intelligent core competitiveness should be enhanced.

Through the analysis of the scale value, the overall scale of some of China's 19 listed logistics enterprises has not reached the value of benchmark 1, indicating that there is still a certain gap between China's listed logistics enterprises and some international logistics enterprises equipped with logistics information technology in terms of resource allocation and advanced logistics information technology. We should develop logistics information and improve logistics informatization ability, so as to improve logistics productivity more effectively [29].

(3) We should innovate business forms and cultivate new growth points of logistics business.

At present, China's e-commerce is developing rapidly, and young people pay more attention to e-commerce online purchasing, which also brings more business opportunities to logistics enterprises. However, the development of e-commerce, logistics and express delivery has also increased, and the competition has continuously lowered the price of express delivery. Some cases of sending to China only cost a few cents, so we know that the profit output will be more and more insufficient. The nineteen listed

logistics enterprises in China should innovate business forms and cultivate new logistics business growth points, so as to achieve the optimal performance of the optimal logistics enterprises [30].

Through the above analysis, it can be concluded that China's 19 listed logistics enterprises have been trying their best to transform in the era of e-commerce, but they will also encounter some difficulties in the actual operation process. The 19 listed logistics enterprises in China have a good business model, but they rely more on e-commerce express delivery, which will limit their development in case of epidemic lockdowns. In the future, China's 19 listed logistics enterprises should conscientiously learn the management of international logistics enterprises and improve logistics performance scientifically and effectively.

## References

- [1] Liao Shaogang, Xie Wendong.(2019). Research on operation performance evaluation of science and technology innovation service platform based on BSC-AHP model. *Research on Science and Technology Management*, 39(14), 64-71.
- [2] Li T, Liang J.(2019). Business performance evaluation of agricultural listed enterprises integrating industry and finance based on RS-DEA. *The Theory and Practice of Finance and Economics*, 40(04), 60-66.
- [3] Liang Yanming.(2018). Research on performance evaluation index of third-party logistics based on balanced scorecard. *Logistics Engineering and Management*, 40(12), 29-31.
- [4] Xu Wenrui.(2018). Empirical analysis of logistics company's business performance under e-commerce economy. *Research of Business Economics*, (15), 97-100.
- [5] Wu B L.(2018). Research on performance analysis

- and countermeasures of Chinese listed logistics enterprises -- Taking twenty listed logistics enterprises of four categories as an example [J]. *Journal of Huaihua University*, 37(03), 25-30.
- [6] Li Shou-lin, ZHAO Rui, Chen Lihua.(2017). Empirical analysis of dynamic efficiency of listed transportation enterprises based on DEA-Malmquist index. *China Journal of Circulation Economics*, 31(12), 92-100.
- [7] Xiong X H.(2017). Operational performance evaluation of listed companies in logistics industry based on DEA model. *Journal of Xinyu University*, 22(03), 74-79.
- [8] Yang Jiawei, WANG Meiqiang.(2016). Performance evaluation of Chinese listed logistics enterprises based on network DEA. *Enterprise Economics*, 35(11), 125-130.
- [9] Zeng Zicen, Li Qi.(2016) Design of performance evaluation index system for logistics enterprises based on EVA. *Journal of Transportation Enterprise Management*, 31(04), 55-58.
- [10] Sun D M.(2019). Research on enterprise financial performance evaluation based on factor analysis: A case study of BYD company limited. *Journal of Inner Mongolia TV University*, (03), 50-55+61.
- [11] Dai Wanliang, Dong Zhiwei.(2018). Comparison of provincial logistics efficiency differences and analysis of influencing factors based on DEA-Tobit. *Journal of Logistics Technology*, 41(03), 11-14.
- [12] Omrani H, Keshavarz M.(2016). A performance evaluation model for supply chain of shipping company in Iran: an application of the relational network DEA. *Maritime Policy & Management*, 43(1), 121-135.
- [13] Luisa Marti, Juan Carlos Martin(2017). Puertas R.A DEA-logistics performance index. *Journal of Applied Economics*, 20(1), 169-192.
- [14] Chang Y T, Zhang N.(2017). Environmental efficiency of transportation sectors in China and Korea. *Maritime Economics & Logistics*, 19(11), 1822-1825.
- [15] Amer Hamdan, K J(Jamie)Rogers.(2018). Evaluating the efficiency of 3PL logistics operations. *Production Economics*, 113, 235-244.
- [16] Jing Q.(2017). Research on financial performance evaluation of media listed companies based on AHP-DEA. *Statistics and Information Forum* (3).
- [17] Chen Yan-li, WANG Lei, JIANG Ming-dong, SHEN Xiao-mei.(2018). Research on enterprise performance and influencing factors of listed manufacturing companies in three northeastern provinces: Based on DEA Malmquist-Tobit Model . *Journal of Industrial Technical Economics*, 37(11), 51-57.
- [18] Li T, Liang J.(2019). Business performance evaluation of agricultural listed enterprises integrating industry and finance based on RS-DEA. *The Theory and Practice of Finance and Economics*, 40(04), 60-66.
- [19] Zhan Rongfu, Huang Lijun.(2018). Analysis on current situation reasons and countermeasures of logistics efficiency in Guangdong-Hong Kong-Macao greater bay area. *Logistics Engineering and Management*, 40(11), 19-22.
- [20] Liu Gangqiao, Shi Jianhua, Li Ming.(2019). An empirical study on the efficiency of logistics industry in Guangdong Province under the background of supply-side reform: Based on SE-SBM-DEA Model. *Journal of Logistics Science and Technology*, 42(01), 126-131.
- [21] Andersen N C Petersen, A.(2010). Procedure for ranking efficient units in data envelopment analysis. *Management Science*, 39(10), 1261-1264.
- [22] Zhang Ke.(2019). Research on enterprise financial performance evaluation based on factor analysis: A case study of BYD Co., LTD. *Journal of Inner Mongolia TV University*, (03), 50-55+61.
- [23] Adam, S.(2018). Critique of international trading companies theorizing "Globalization" the age of enlightenment [J]. *Political Theory*, 36(2), 185-212.
- [24] Honky M. S.(2006). Benchmarking the operational efficiency of 3PL providers using data envelopment analysis [J]. *Supply Chain Management: An International Journal*, 1(3), 259-261.
- [25] Michael K, Paul R.(2004). Evaluating the



performance of third-party logistics arrangement a relationship marketing perspective. *Journal of Supply Chain Management*, 40(1), 35-51.

- [26] Fare, R Grosskopf, S., Norri, S. M. (1997). Productivity growth, technical progress, and efficiency change in industrialized countries. *American Economic Review*, (87), 1040-1043.
- [27] Gunasekaran, A., Patel, C., Tirtiroglu, E.(2001). Performance measures and metrics in a supply chain environment. *International Journal of Operations and Production Management*, 21(1/2), 71-87.
- [28] Goyal, P., Rahman, Z., Kazmi, A. A. (2013). Corporate sustainability performance and firm performance research. *Management Decision*, 51(1-2), 361-379.
- [29] Horta I M, Camanho A S.(2015). A nonparametric methodology for evaluating convergence in a multi-input multi-output setting. *European Journal of Operational Research*, 246(2), 554-561.
- [30] Lozano, S., Villa, G., Canca. D. (2021). Application of centralised DEA approach to capital budgeting in Spanish ports. *Computers & Industrial Engineering*, 60(3), 455-465.

### 왕 능 봉(Lingfeng Wang)



- 2002년 6월 현재 : 천주연초물류유한회사 고급경제사
- 2020년 12월 현재 : 연세대학교 경영학 박사
- 2008년 9월~2011년 7월 : 전자과학기술대학 소프트웨어공학 석사
- 2002년 9월~2005년 7월 : 서남사범대학 중국어문학학부 졸업
- 관심분야 : 물류 기업 관리 전자상거래
- E-Mail : 441027704@qq.com

### 심 재 연 (Sim, Jae-Yeon)



- 1985년 2월 : 조선대학교 회계학과 (경영학 학사)
- 1990년 2월 : 조선대학교 대학원 회계학과 (경영학 석사)
- 1995년 2월 : 조선대학교 대학원 경영학과 (경영학 박사)
- 1995년~현재 : 세한대학교 경영학과 교수
- 관심분야 : 회계정보시스템, 정부회계, 인적자원관리
- E-Mail: : simjy@sehan.ac.kr