Frontiers in Business, Economics and Management
ISSN: 2766-824X | Vol. 16, No. 1, 2024

Research on Input-Output Efficiency and Influencing Factors of Listed Logistics Enterprises

Qin Zhao

School of Business Administration, Henan Polytechnic University, Jiaozuo 454000, China

Abstract: This paper mainly analyzes the input-output efficiency of 25 listed logistics enterprises from 2012 to 2020, and draws the following conclusions: 1) From the perspective of the change of comprehensive technical efficiency, the comprehensive technical efficiency change index of most enterprises is less than 1, which indicates that the improper management mode and decision-making of these enterprises hinder the improvement of enterprise efficiency. The comprehensive technical efficiency of listed logistics enterprises is analyzed by using the BCC model, and the conclusion is that the comprehensive technical efficiency of most listed logistics enterprises is less than 1 during 2012-2020, which indicates that the input-output of most listed logistics enterprises is not optimal. 2) Regional GDP, the proportion of employees with bachelor's degree or above and the total asset turnover have no significant influence on the input-output efficiency of listed logistics enterprises; The total assets of enterprises are negatively correlated to the input-output efficiency.

Keywords: Listed logistics enterprises, Input-output efficiency, Malmquist index model, BCC model, Multiple linear regression model.

1. Introduction

Modern logistics is the product of economic globalization and an important service field to promote economic globalization. 2021 is the opening year of the "14th Five-Year Plan", for China's logistics enterprises, policy support has been strengthened, the 14th Five-Year Plan is the next five to 15 years of national economic and social development policy documents, clearly pointed out the need to establish a modern logistics system, and for the logistics industry quality development of the direction. Logistics is frequently mentioned in the 14th Five-Year Plan documents, which shows that the logistics industry plays an important role in economic development, and the country attaches great importance to the development of the logistics industry. Although China's logistics industry started late, due to the rapid development of the national economy and the support of national policies for the logistics industry, China's logistics industry continues to develop rapidly, the logistics system is constantly improved, the logistics industry is becoming more mature and more standardized, and has become an important part of the national economy. It plays an important role in promoting the adjustment of industrial structure, transforming the mode of economic development and improving the competitiveness of the people's economy [1]. However, in the process of logistics operations, the existing problems are gradually exposed, such as the operation efficiency of logistics enterprises cannot meet the needs of consumers, the cost increases rapidly, the growth rate of logistics business volume is slow and other factors, so that their profit growth rate is low, the economic efficiency continues to decline, and the problems in the operation and management of logistics enterprises. These problems restrict the development of China's logistics industry, resulting in low input-output efficiency of listed logistics companies [2]. To improve the quality of China's economic growth or change the economic growth model, the main content is to improve the input-output efficiency and improve the economic structure. In recent years, the vigorous development of e-commerce has led to the rapid growth of logistics economy, and the profits of logistics industry in the market have increased significantly. At the same time, logistics, as the third source of profits for enterprises, is also crucial to the development of China's economy. Therefore, it is a general trend to study and analyze the input-output efficiency of logistics enterprises and its influencing factors.

2. Research Methods

2.1. Data Envelopment Method

It is a non-parametric method used to analyze the efficiency evaluation of an individual or unit. The basic principle is that the input or output of the decision-making unit remains unchanged, the relative efficiency of the production front is determined by linear programming and statistical data, and the relative efficiency is evaluated by comparing the degree of deviation between the decision-making unit and the production front. The traditional DEA model is static analysis of efficiency, the most common models are CCR model and BCC model.

Principle of Malmquist exponential model. To measure the panel data that integrates the cross-section data and the time series data, the DMU has the data of both the cross-section and the time series. Since the efficiency values of different years are not comparable, it is impossible to simply compare the time series with the efficiency results of each year. Therefore, the traditional static DEA model can not meet the requirements of panel data evaluation, so the DEA-Malmquist index model is adopted in this paper.

(1) Malmquist index definition:

Suppose there are n decision units, and each decision unit uses m inputs to obtain s outputs in t period. $x_j^t = (x_{1j}^t, x_{2j}^t, ..., x_{mj}^t)^T$ represents the input index value of j decision unit in the t period, and $y_j^t = (y_{1j}^t, y_{2j}^t, ..., y_{sj}^t)^T$ represents the output index value of the j decision unit in the t period. And both are positive, t=1,2,...,T.

In the case of variable returns to scale, the distance function

of (x^t, y^t) in phase t is $D_C^t(x^t, y^t)$, and the distance function in phase t+1 is $D_C^{t+1}(x^t, y^t)$; The distance function of (x^{t+1}, y^{t+1}) in phase t is $D_C^t(x^{t+1}, y^{t+1})$, and the distance function in phase t+1 is $D_C^{t+1}(x^{t+1}, y^{t+1})$.

The change of technical efficiency from t to t+1 under the technical conditions of t phase:

$$M^t = \frac{D_C^t(x^{t+1}, y^{t+1})}{D_C^t(x^t, y^t)} \tag{1}$$

The change of technical efficiency from t to t+1 under the technical conditions of t+1 phase:

$$M^{t+1} = \frac{D_C^{t+1}(x^{t+1}, y^{t+1})}{D_C^{t+1}(x^t, y^t)} \tag{2}$$

The geometric average of the two Malmquist productivity indices above is used to calculate the change in productivity from period t to t+1:

$$M(x^t, y^t, x^{t+1}, y^{t+1}) = (M^t \times M^{t+1})^{\frac{1}{2}} = \left[\frac{D_C^t(x^{t+1}, y^{t+1})}{D_C^t(x^t, y^t)} \times \frac{D_C^{t+1}(x^{t+1}, y^{t+1})}{D_C^{t+1}(x^t, y^t)}\right]^{\frac{1}{2}} \tag{3}$$

(2) BCC-DEA model. The BCC model can be used to measure the comprehensive technical efficiency, pure technical efficiency and scale efficiency when the DMU is in the situation of changing returns to scale, while the CCR model can only describe the total efficiency when the DMU is in the situation of constant returns to scale. BCC model adds production scale constraints on the basis of CCR model, and removes the assumption of constant returns to scale in CCR model in concept and application[3]. Based on the above reasons, the BCC model is used in this paper to explain the operating conditions and scale changes of listed logistics enterprises.

The standard programming formula of output-oriented BCC model:

$$\begin{aligned} & Min[\phi - \varepsilon(e^T s^- + e^T s^+)] \\ s.t. \quad & \sum_{j=1}^{n} \lambda_j \chi_{ij} + s^- = \chi_{ik}; \\ & \sum_{j=1}^{n} \lambda_j \chi_{ij} - s^+ = \theta y_{rk}; \\ & \sum_{j=1}^{n} \lambda_j = 1; \\ & \lambda_j \geq 0, s^+ \geq 0, s^- \geq 0; \\ & i = 1, 2, ..., m; \ r = 1, 2, ..., q; \ j = 1, 2, ..., n. \end{aligned} \tag{4}$$

If θ<1, the DEA is invalid; If θ=1 and one of s^+ and s^- is not 0, the DEA is weak and efficient. If θ=1 and both s^+ and s^- are 0, it indicates that DEA is effective.

(1) Multiple linear regression model

Multiple linear regression model is usually used to study the relationship between a dependent variable and multiple independent variables, and regression analysis can be used to calculate the exact degree of correlation between influencing factors and the degree of regression fitting. This paper will explore the factors that affect the input-output efficiency of listed logistics enterprises, and use multiple linear regression model to analyze them.

Let the dependent variable be Y, and the k independent variables are $X_1, X_2, ..., X_k$. It describes how the dependent variable Y depends on the independent variables $X_1, X_2, ..., X_k$ and the error term ε. The equation is called a multiple regression model. Its general form can be expressed as:

$$Y = \beta_0 + \beta_1 X_1 + ... + \beta_k X_k + e \tag{5}$$

Where e is the error term, indicating the influence factors of other factors except X_1, X_2,…X_k on Y and test or measurement errors; β_0, β_1,…β_k is an unknown parameter to be estimated.

2.2. Sample Selection

In this section, 25 listed logistics companies with logistics services as their main business from 2012 to 2020 are selected as research samples. The relevant data of the research samples come from Juchao News Network, NetEase Finance and Sina Finance. See Table 1 for details.

Table 1. Names and codes of 25 listed logistics enterprises

Serial number	Stock code	Enterprise name
1	002352	Sf Express Holdings
2	601919	Cosco Sea Control
3	603329	Shanghai Yashi
4	601111	Air China
5	601008	Lianyungang
6	601598	sinotrans
7	600787	China Reserve Corporation
8	603056	Deppon
9	603223	Hengtong Stock
10	000088	Yantian Port
11	002210	Pegasus International
12	002120	Yunda Stock
13	600233	Yto Express
14	300013	Xinning Logistics
15	600057	Xiangyu Xiamen
16	002468	Sto Express
17	603535	Cazenove International
18	601866	Coscoshipping Development
19	600180	CCS
20	600179	Antong Holdings
21	000626	Grand industrial Holding
22	603128	Huamao Logistics
23	300240	Feiliks Logistics
24	002492	Winbase
25	603066	Inform Storage

2.3. Index Construction

In this paper, total operating cost, salary payable to employees and fixed assets are taken as input indicators,

while total operating income and net profit are taken as output indicators [4] [5]. The details are shown in Table 2.

Table 2. Input and output index system of input-output efficiency evaluation of listed logistics enterprises

Index type	Index name	Index interpretation
Input pointer	Total operating cost	In the operation and management of enterprises, the cost of providing logistics services
	Payroll payable to employees	The remuneration given by the enterprise to the employee for obtaining the labor provided by the employee
	Fixed assets	When enterprises provide corresponding logistics services, they need to have corresponding equipment to maintain the operation of enterprises
Output index	Gross operating income	It is the business income obtained by the enterprise through the sale of products and the provision of logistics services
	Net profit	It is the part of the total profit deducting income tax, which can directly reflect the operating effect of the enterprise

2.4. Processing of Indicator Data

DEA method itself does not carry out direct data synthesis, so the most effective decision making unit does not depend on the dimensions of input and output data values, so it is not necessary to carry out dimensionless data processing before implementation. However, if there are negative output indicators, such as the negative net profit index selected in this paper, it cannot be solved in DEAP2.1 software without processing. Therefore, negative values must be processed before the data is run. Specific treatment methods are as follows:

Min-Max standardization

For the sequence $X_1, X_2, ...X_n$ is transformed

$$y_i = \frac{x_i - \min\limits_{1 \le j \le n} \{x_j\}}{\max\limits_{1 \le j \le n} \{x_j\} - \min\limits_{1 \le j \le n} \{x_j\}} \quad (6)$$

After this transformation, zero will appear, so the very small number 10^{-8} will be used instead.

3. Analysis of Input-Output Efficiency Level Measurement Results

3.1. Comprehensive Technical Efficiency Analysis of Listed Logistics Enterprises

The DEA-BCC model is used to analyze the comprehensive technical efficiency level of listed logistics enterprises from 2012 to 2020, and the operation results of the model are shown in Table 3.

Table 3. Comprehensive technical efficiency level of listed logistics enterprises

Company name	2012	2013	2014	2015	2016	2017	2018	2019	2020
Sf Express Holdings	0.939	1.000	1.000	1.000	0.259	0.901	0.923	0.344	0.177
Cosco Sea Control	0.730	0.735	0.773	0.730	0.332	0.797	0.795	0.161	0.202
Shanghai Yashi	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Air China	0.905	0.902	1.000	1.000	0.033	0.859	0.825	0.338	0.162
Lianyungang	0.960	0.962	0.781	0.884	0.632	0.795	0.770	0.723	0.435
sinotrans	0.873	0.885	0.899	0.904	0.317	0.850	0.889	0.349	0.174
China Reserve Corporation	0.899	0.920	0.925	0.918	0.539	0.876	0.931	1.000	0.348
Deppon	0.899	0.874	0.896	0.937	0.451	0.909	0.953	0.090	0.204
Hengtong Stock	0.904	0.901	0.904	0.936	0.773	0.907	0.937	0.592	0.399
Yantian Port	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.505	0.531
Pegasus International	0.930	1.000	1.000	1.000	0.990	0.982	1.000	1.000	1.000
Yunda Stock	0.834	0.823	0.852	1.000	0.428	1.000	1.000	0.477	0.146
Yto Express	0.955	0.928	0.884	0.940	0.501	0.916	0.938	0.430	1.000
Xinning Logistics	0.971	0.899	0.752	0.714	0.571	1.000	0.877	0.562	0.592
Xiangyu Xiamen	0.939	0.949	0.988	0.937	0.790	0.955	0.965	0.709	0.535
Sto Express	0.843	0.847	0.871	0.893	1.000	1.000	1.000	0.469	0.151
Cazenove International	1.000	0.962	0.965	0.882	1.000	1.000	1.000	0.876	0.929
Coscoshipping Development	0.784	0.818	0.892	0.851	0.530	0.812	0.816	0.202	0.116
CCS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Antong Holdings	0.820	0.847	0.667	0.691	0.811	1.000	1.000	0.307	0.313
Grand industrial Holding	0.916	0.977	0.972	1.000	1.000	0.317	0.985	0.981	0.951
Huamao Logistics	0.900	0.937	0.966	0.966	0.566	0.942	0.977	0.636	0.436
Feiliks Logistics	0.925	0.913	0.916	0.902	0.465	0.903	0.920	0.533	0.284
Winbase	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Inform Storage	1.000	0.913	1.000	1.000	1.000	0.210	1.000	1.000	1.000

Comprehensive technical efficiency = pure technical efficiency * scale efficiency. If the comprehensive efficiency is equal to 1, it means that the input and output of the DMU are comprehensively effective, that is, both technically effective and scale-efficient. If the comprehensive efficiency is less than 1, and the pure technical efficiency is equal to 1, it means that at the current technical level, the use of its input resources is efficient, and the fundamental reason for failing to achieve comprehensive efficiency is its ineffective scale, so the focus of its reform lies in how to better play its scale efficiency.

According to the result analysis in Table 5, the following results can be summarized:

(1) The comprehensive technical efficiency of listed

logistics enterprises is unbalanced. As shown in Table 5, in 2020, the maximum value of comprehensive technical efficiency is 1, but the minimum value of comprehensive technical efficiency is only 0.103, indicating that there are great differences in the comprehensive technical efficiency of listed logistics enterprises.

(2) In 2020, the comprehensive efficiency of only 6 listed logistics enterprises is equal to 1, which indicates that only the input-output of these 6 listed logistics enterprises is effective, that is, the enterprise efficiency has reached the best level. For most enterprises, the comprehensive efficiency is less than 1, indicating that at least one of the pure technical efficiency or scale efficiency of the enterprise is less than 1. For example, Cazenove International, its scale efficiency is less than 1, while its pure technical efficiency is equal to 1, indicating that Cazenove International's input-output is not the best proportional relationship, and the ratio of output benefit must be adjusted for each input factor to optimize resource allocation. To realize the Pareto optimization of enterprise resources.

(3) In 2020, only 6 listed logistics enterprises have a comprehensive efficiency of input-output efficiency of 1, which is relatively efficient in input-output, 19 listed logistics enterprises have a comprehensive efficiency of less than 0.6, and 8 listed logistics enterprises have a comprehensive efficiency of less than 0.2, which is highly likely to be affected by the outbreak of COVID-19 in 2020. This shows that these three logistics enterprises have been more impacted by the COVID-19 epidemic than other logistics enterprises.

3.2. Projection Analysis

In the above table, it can be seen directly whether the enterprise is in the DEA effective state, and the optimal deconstruction of all DEA-effective decision units is a production frontier of the research sample, while there is a distance between the non-DEA effective units and this production frontier. By adjusting this distance, enterprises can adjust the non-DEA effective decision making unit to the effective decision making unit. Taking 2020 as an example, the projection analysis results of invalid DMU are shown in Table 4.

Table 4. Projection analysis results

Enterprise name	Output indicator		Input index		
	Gross operating income	Net profit	Total operating cost	Payroll payable to employees	Fixed assets
Cosco Sea Control	0.000	83.699	0.000	-444.141	-0.149
Shanghai Yashi	47.381	0.000	-340.821	-301.281	-0.063
Lianyungang	33.340	323.343	-293.709	-84.037	-0.081
sinotrans	54.684	0.000	-494.842	-374.331	-0.087
China Reserve Corporation	0.000	0.000	0.000	0.000	0.000
Deppon	0.000	74.505	-416.967	-198.320	-0.098
Yantian Port	5.734	2.044	-140.473	-157.481	-0.054
Pegasus International	39.413	0.000	-194.638	-222.430	-0.062
Xinning Logistics	102.597	0.000	-383.905	-0.125	-0.480
Sto Express	0.000	21.666	-143.764	-202.961	-0.062
Cazenove International	0.000	0.000	0.000	0.000	0.000
CCS	32.144	376.593	-105.912	-169.008	-0.047
Antong Holdings	0.000	0.000	0.000	0.000	0.000
Grand industrial Holding	39.753	0.000	-338.093	-73.180	-0.061
Huamao Logistics	0.000	0.000	0.000	0.000	0.000
Feiliks Logistics	81.902	0.000	-71.537	-20.180	-0.018
Winbase	0.000	652.838	-126.212	-110.955	-0.046
Inform Storage	19.899	393.245	-191.449	-141.031	-0.061

From the perspective of input, the total operating cost of input index is redundant except for Cosco Sea Control, China Reserve Corporation, Cazenove International, Antong Holdings and Huamao Logistics. These enterprises should take certain measures to reduce operating costs and further improve enterprise efficiency. In addition to China Reserve Corporation, Cazenove International, Antong Holdings and Huamao Logistics to achieve the best, other logistics enterprises are redundant, these logistics enterprises should reduce the standard of employee compensation. In addition to the optimal fixed assets of China Reserve Shares, Cazenove International, Antong Holdings and Huamao Logistics, other logistics enterprises should reduce the input of fixed assets, so as to improve the input-output efficiency of enterprises.

From the perspective of output, the output indicators of total operating income and net profit are insufficient, and logistics enterprises should take corresponding measures to improve the output level.

According to the data in Table 4, logistics enterprises can clarify the improvement range of various indicators. For example, in order to achieve the effective DEA status, Shanghai Yasi needs to reduce the total operating cost by 340.821, pay employees 301.281, fixed assets by 0.063, and increase the total operating income by 47.381.

4. Empirical Analysis of Influencing Factors of Input-Output Efficiency of Listed Logistics Enterprises

4.1. Study on Influencing Factor Index

4.1.1. The selection of indicators

The operation efficiency of an enterprise is very important for its long-term development. The factors that affect the efficiency of enterprises are the internal and external environment. According to PEST analysis, the external macro-environment analysis includes the analysis of political

environment, economic environment, social environment and technical environment. These external macro-environments have an impact on enterprise strategy and thus affect enterprise efficiency. When conducting external environment analysis, the enterprise will carry out SWOT analysis on the basis of PEST analysis, where S (Strength) refers to the enterprise's own advantages; W (Weakness) refers to an enterprise's own weakness; O(Opportunities) refers to the opportunities in the external environment of the enterprise; T (Tthreat) indicates the external environment of an enterprise. The advantages and disadvantages of the enterprise itself can be reflected in the aspects of capital, products, technical level, staff literacy and so on. Based on the above analysis and by combing relevant literature, when studying the influencing factors of input-output efficiency of listed logistics enterprises, the influencing factors are mainly analyzed from the aspects of economic development level, enterprise scale, staff literacy, total asset turnover, management efficiency and operating cost of the region where the logistics enterprises are located [6].

Table 5. Index system of influencing factors of input-output efficiency of listed logistics enterprises

Index name	Index interpretation
Level of regional economic development	A key indicator to measure the level of economic development within a country or region, using regional GDP to measure the level of economic development
Total assets of enterprise	All the assets owned by an enterprise that can generate economic profit
Staff literacy	It refers to the ideological quality and cultural quality of employees working in the enterprise. This section uses the proportion of employees with bachelor's degree or above to measure the quality of employees
Turnover of total assets	An important indicator to measure the operating capacity of an enterprise
Management efficiency	It is measured by the proportion of the total profit of the enterprise in the management expenses
Main business cost	The cost of the service provided by the enterprise

4.1.2. Sample selection

According to the availability of data, 21 listed logistics enterprises from 2015 to 2020 are selected as research objects. These 21 listed logistics enterprises are obtained by removing some logistics enterprises with missing data on the basis of the 25 listed logistics enterprises mentioned above. The comprehensive technical efficiency of these 21 listed logistics enterprises from 2015 to 2020 was obtained by using the same method as above. The comprehensive technical efficiency of each listed logistics enterprise obtained from the analysis is taken as the explained variable, and the proportion of GDP, total assets, fixed assets and employees with bachelor's degree or above in the region where the logistics enterprise is located is taken as the explanatory variable. The data of explanatory variables were obtained from Juchao Information Network and China Statistical Yearbook.

4.2. Result Analysis

The above indicators that have little impact on the comprehensive technical efficiency are applied to the backward automatic screening function of SPSS, and the final results are obtained as shown in Table 6. After four times of modeling, the total asset turnover rate, the proportion of employees with bachelor's degree or above, and regional GDP indicators are successively excluded.

Table 6. Analysis of regression results

Model		Unnormalized coefficient		Standardization coefficient	t	significant
		β	Standard error	β		
1	Constant	9.947E-17	0.080		0.000	1.000
	Regional GDP	-0.115	0.081	-0.115	-1.422	0.158
	Total assets of enterprise	-0.436	0.087	-0.436	-5.041	0.000
	The proportion of employees with bachelor degree or above	0.095	0.090	0.095	1.050	0.296
	Turnover of total assets	0.046	0.089	0.046	0.511	0.610
2	Constant	8.937E-17	0.080		0.000	1.000
	Regional GDP	-0.118	0.081	-0.118	-1.457	0.148
	Total assets of enterprise	-0.448	0.083	-0.448	-5.403	0.000
	The proportion of employees with bachelor degree or above	0.113	0.083	0.113	1.361	0.176
3	Constant	1.581E-16	0.080		0.000	1.000
	Regional GDP	-0.113	0.081	-0.113	-1.400	0.164
	Total assets of enterprise	-0.422	0.081	-0.422	-5.212	0.000
4	Regional GDP	1.835E-16	0.081		0.000	1.000
	Total assets of enterprise	-0.431	0.081	-0.431	-5.316	0.000

According to the above regression analysis results, the factors affecting the input-output efficiency of listed logistics enterprises are analyzed as follows:

There is no significant correlation between the regional GDP of listed logistics enterprises and the input-output efficiency of listed logistics enterprises. This indicates that the good macroeconomic external environment does not promote the input-output efficiency of listed logistics enterprises, and that enterprises do not make reasonable use of the good external economic environment to carry out their own development.

The total assets of listed logistics enterprises have a significant negative correlation with their input-output efficiency. For any enterprise, the more total assets of the

enterprise, it will promote the development of the enterprise. However, in the above analysis, the total assets show a negative correlation with listed logistics enterprises, which indicates that enterprises do not take advantage of their internal advantages to form economies of scale and thus improve the input-output efficiency of logistics enterprises. It has even hindered the efficiency level of some logistics enterprises.

The employee literacy of listed logistics enterprises (measured by the proportion of employees with bachelor's degree or above) is not strongly correlated with the input-output efficiency of logistics enterprises. Generally speaking, the higher the employee literacy, the higher the efficiency of the work, which can improve the efficiency level of the enterprise as a whole. However, in the analysis of this section, there is no obvious promotion effect of employee literacy on the efficiency of logistics enterprises, which indicates that logistics enterprises do not pay much attention to the cultivation of employee literacy.

The total asset turnover reflects the overall operation capability of the enterprise. Generally speaking, the greater the total asset turnover rate, the stronger the capital turnover capacity of the enterprise, the stronger the operation capacity of the enterprise, the higher the input-output efficiency of the enterprise. However, there is no significant correlation between total asset turnover and input-output efficiency of listed logistics enterprises in the above regression analysis results.

5. Countermeasures and Suggestions for Promotion

In view of the evaluation and analysis of the input-output efficiency of listed logistics enterprises, in order to improve the input-output efficiency of listed logistics enterprises and other logistics enterprises and better enhance their competitiveness, this paper gives targeted suggestions based on the analysis results of the above influencing factors.

(1) Grasp a good external macroeconomic environment of the enterprise.

According to the results of regression analysis in the above section, regional GDP does not have a significant positive effect on the input-output efficiency of listed logistics enterprises, which indicates that logistics enterprises ignore their own economic environment and do not make reasonable use of the external economy to promote themselves. And under the current circumstances, the state has increased support for the logistics industry. Therefore, enterprises should strengthen their ability to use the external economic environment, make full use of external resources, and then improve their competitiveness.

(2) Make full use of the internal advantages of the enterprise to improve the innovation ability of the enterprise. Generally speaking, the total assets of enterprises have a positive impact on the efficiency of enterprises, so enterprises should make full use of their own advantages and allocate resources reasonably. Innovation drives the long-term development of enterprises, enterprises must pay attention to the improvement of innovation ability, increase investment in technology, give full play to the advantages of scale economy, improve the operation capacity of enterprises, enhance their own competitiveness, and make the efficiency of enterprises reach the Pareto optimal level.

(3) Improve staff literacy. Generally speaking, employee literacy has a positive effect on the improvement of enterprise efficiency. Employees with low literacy will increase the demand for employees, and then increase the input of management cost and employee salary, thus making the input-output efficiency of enterprises low. Therefore, enterprises should pay attention to the improvement of employees' ability and increase the training of employees' technical and management ability. Introduce more highly educated talents, establish a set of sound and effective management mechanism and incentive mechanism, and ensure that capable employees are fully invested in the construction of enterprises.

References

[1] T.T. Zhou, “Study on total factor productivity of logistics industry in Shandong Province based on DEA-Malmquist index,” Technology Innovation Monthly, 2021, 34 (05): 69-72.

[2] Y. Wu, “Research on Input-Output Efficiency and Influencing Factors of Logistics Listed Companies,” Xi 'an University of Science and Technology, 2019.

[3] L.Y. Ren, X.F. Li, “Research on innovation efficiency and Influencing factors of high-tech enterprises in Tianjin Port Free Trade Zone: Based on data envelopment analysis method and Tobin model,” Technology and industry, 2023, 23 (18): 47-53.

[4] G.L. Li, “Research on input-output efficiency measurement and optimization countermeasures of listed logistics enterprises in China,” Hebei GEO University, 2022.

[5] Q. Li, B.J. Liu, “Research on the efficiency of listed companies in information transmission, software and information technology services: Based on DEA and DEA-Malmquist models,” Prices in China, 2020, (03): 104-107.

[6] L.Y. Cao, “Study on input-output efficiency of logistics enterprises and its influencing factors,” Jiangnan University, 2022.