

Classified Comparison of Operational Efficiency to Internet Company in China Based on DEA Model

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Abstract

In order to evaluate the operational efficiency of the Internet Company in China, this paper constructed the index system of the efficiency evaluation at first. Then we appraise the overall efficiency and variation tendency about Internet Company of China Based on DEA method from cross section data and temporal patterns. At the same time this paper classifies the Internet Company into three types: E-commerce, Information supplier, and Communication-Equipment supplier and make a comparative analysis to the performance and changing trend of different types. The research suggests: the whole efficiency of our country's Internet Company is not effective and there exist serious polarization. The lack of resource allocation and management lead to the downward trend of these companies. From the classification perspective, the content and information service provider type's operational efficiency is the highest, and the communication device provider type is the lowest. The fastest decline type in operational efficiency is the communication device provider type, and the electronic commerce type's development is stable. The variance of operating efficiency is gradually expanding of these three type's Internet Company.

Keywords: *Internet companies; operational efficiency; DEA; Classified Comparison*

1. Introduction

In recent years, with the rapid development of the economy, the internet industry has been developing rapidly in China. The internet industry's scale is in rapid expansion, the business model is in continuous innovation, and its' application field is in continuous extension, the service content is also constantly enriched. In China, the development of the internet industry has played an important role in promoting the development of China's real economy. But China's internet industry is still in the exploration and development stage, there are blind competitions between internet enterprises. There are many problems caused the decline in economic benefits of a number of internet enterprises, resulting in a large number of waster of resources such as the one-sided pursuit of expansion, low efficiency in management. To evaluate the operating performance of different types of internet enterprise can not only guide the investors' investment behavior but also help managers to find the problems and deficiencies. As we all know, better management can improve these enterprise's comprehensive competitiveness.

At present, many scholars have studied the operating performance of different enterprise from different angles. He Liangliang *et al.* [1] classifying, grading and sorting the 21 industries divided from whole quoted company which is provided in "evaluation report" in April 30, 2006. They adopting factor analysis, cluster analysis and principal component

analysis method of multivariate statistical to analysis the main factors and reasons which affecting the performance of the listed company. At last, the analysis in [1] made a comprehensive evaluation. Zhang Bo [2] proposed two stage DEA model to evaluate the performance of 26 listed companies which belong to property sector. Chen Liang [3] analysis the operating performance of the retail listing corporation in China using DEA method. Wang Xiping [4] selected 12 automobile listing corporations in China to evaluate their performance. Liu Wenhui [5] constructed the DEA model which only has the output and more subsystems to evaluate the performance of the electronic industry from listed companies. Carlos Serrano-Cinca *et al.* [6] used DEA approach and multivariate analysis method to assess efficiency in dot com firms. Zhao Meng [7] adopted dynamic DEA method for complex system to evaluate the performance of four categories of manufacturing industry from 8 economic zones. Ding Zhongming *et al.* [8] used the DEA model to do the empirical research about the efficiency of 15 commercial banks selected from China and abroad. Gao Ying [9] adopted the network DEA method to evaluate the sub processes' efficiency of different railway transport enterprises in 2007 and provided some suggestions to enhance the efficiency of these enterprises. Zhang Renshou *et al.* [10] evaluate the management performance of cultural industries from 13 provinces such as Guangdong in 2007. Ramo ´n Sala-Garrido *et al.* [11] used the DEA method to analyze the performance of the sewage treatment plant in Spain. Yan Luo *et al.* [12] discussed and evaluated the operating performance of 14 commercial banks in China with DEA method. Li lin *et al.* [13] proposed an empirical analysis on the regional economic synergistic development (RESD) in China with extending DEA approach. Wu Xue [14] made an empirical analysis of the relationship between input and output of science and technology of 25 provinces in China. However, so far all these studies hadn't based on the Internet enterprise and there had no research on the operating efficiency about these Internet enterprises in China.

This paper concentrates on the study of efficiency in internet enterprise in China. Not all internet enterprises are similar. Some sell products in internet; others product communication equipment for internet; and others provide content and information service in internet. At first the paper classifies the Internet Company into three types with independent and interdependent. Then comparative analysis the performance and changing trend of different types through evaluate its efficiency in both horizontal and vertical using Data Envelopment Analysis (DEA), a nonparametric approach to the empirical estimation of production functions. For an introduction to DEA, we can see, for example, Refs. [15-17].

The paper unfolds as follows. Section 2 concentrates on the analysis of data classification and DEA model specification. This is followed by an analysis of efficiency scores of Internet companies in China using DEA model. Section 4 discusses the efficiency of three types of Internet companies and the cause of corresponding score of the efficiency. A concluding section summarizes the findings.

2. DEA Model

The objective of this section is to analyze the DEA model about our research. This part starts by describing the classification of the Internet enterprises in China. It continues with a discussion of model specification, which involves the selection of inputs and outputs that enter the model. It ends by producing DEA efficiency estimates.

2.1. The Classification and Data

Internet enterprise is heterogeneous. It covers many different activities. Some firm, conduct all their activities on the internet. These companies sell stuff online, to consumers,

business, or both. The goods they sell involved in all our daily life. We classified this type is E-commerce company.

Some firms whose business activity is based on offer content or information service such as Baidu to consumers we classified it is Content-Information provider company. These are companies that run Web sites designed to be gateways to the Internet.

We classified the third type of Internet company is Communication-Equipment Supplier whose business mainly depend on produce communication equipment to meet the need of Internet. These companies sell goods such as Internet hardware device, the router, the switch to other companies. It is the upstream suppliers of Content-Information-Provider and E-commerce companies. In China HuaWei company is a famous representation of this type.

Internet enterprises that we selected to study are the listed company at Shenzhen Stock Exchange, Shanghai Stock Exchange, Hong Kong or New York Stock Exchange, Nasdaq Stock Market. At last a total of 26 firms we selected in this paper to empirical analysis, of these 16 were content-information providers, 7 were communication-equipment suppliers, 3 were E-commerce companies. Table 1 shows the information of the 26 firms.

2.2. DEA Model Specification

As we all known an efficient firm is defined here as one that, which can obtain high levels of output with few resources. Efficiency can be measured in many ways, DEA method has the advantages of using multi input and multi output index to evaluate the efficiency of target. In DEA modeling the selection of inputs and outputs is an important decision. Different inputs and outputs combinations will produce different efficiency rankings of companies. The paper selects the inputs and outputs on the basis of the following two principles: At first, the indexes must meet the requirement of DEA model. For example, the data caliber is unified and the data is comparable. Secondly, the indexes can satisfy the evaluation requirement and effectively reflect the DMUs' operating performance. To avoid the linear correlation in the input and output set, the number of DMU should be not less than 2 times of the input and output variables. The procedure described below reflects these principles.

Inputs are mainly considered from manpower and capital investment. In this study four inputs have been considered: the number of employees, administration expenses in RMB, total assets in RMB and main business costs (also in RMB). The number of employees is a generally accepted input in this type of study. Administration expense, total asset and main business cost were chosen as inputs because they are all typical input in DEA studies in other areas such as banking, retailing.

The outputs considered have been net profits and prime operating revenues in RMB. These two outputs were chosen because it is the direct embodiment of output.

We obtained financial information from the annual reports of these Internet enterprises on Sina, <http://sina.com>. Sohu, <http://sohu.com>. and U.S. Securities and Exchange Commission, <http://www.sec.gov>.

In summary, the inputs and outputs considered are:

Input A: Number of employees

Input B: Administration expenses (¥000)

Input C: Total assets (¥000)

Input D: Main business costs (¥000)

Output 1: Net profits (¥000)

Output 2: Prime operating revenues (¥000).

Table 1. The 26 Internet Firms and their Type, together with the Values of the Four Inputs and Two Outputs in 2011

Firm	Type	Input				Output	
		(A)Employees	(B)Expenses	(C)Assets	(D)Costs	(1)Profits	(2)Revenues
Wangsu Tech	Information supplier	695	5127.71	15864.4	38579.06	5472.17	54214.21
LeTV	Information supplier	1004	3050.87	16559.7	27509.07	13112.11	59855.59
Shunwang Tech	Information supplier	473	5892.53	1817.84	14012.86	6369.01	17269.09
TRS Tech	Communication-equipment supplier	506	4882.08	5725.28	3876.79	7339.05	19118.56
365 NET	Information supplier	964	4286.51	1007.29	1298.82	7233.39	22958.74
Zhangqu Tech	Information supplier	254	2684.08	7991.69	8625.08	5568.67	18364.45
People.com.cn	Information supplier	1337	6965.8	4638.43	19490.6	13947.86	49726.24
263 Net	Information supplier	465	6900.60	5360.84	12358.28	7124.94	29655.20
Datang Telecom	Communication-equipment supplier	3058	37024.38	34251.1	372941	2477.17	450650.34
Haihong Group	E-commerce	420	11432.63	8975.05	8774.91	1800.07	16279.04
ZTE	Communication-equipment supplier	89786	243170.3	700382	6015740	206016.6	8625445.6
Shengyibao	Information supplier	1079	3128.33	7564.55	1948.43	3234.01	14409.99
Jiaodian Tech	Information supplier	1667	5914.21	2602.29	9038.07	16309.86	42441.84
Technology Co.Ltd	Information supplier	2285	5244.29	7080.87	8017.21	2465.27	26171.08
Tuwei information	Information supplier	2163	7986.71	6008.39	16568.2	6620.96	37166.36
Gaohong Group	Communication-equipment supplier	925	8698.96	18740.4	381580	2347.32	408232.31
Beiwei Communication	Information supplier	496	6788.22	4695.4	13680.5	1165.83	23842.06
Guomai Tech	Communication-equipment supplier	1737	17035.62	11672.7	48937.1	11540.94	86202.52
Shiji Tingli	Communication-equipment supplier	1430	9038.81	7236.48	16161.5	8840.68	37613.1
Tianyuandike	Communication-equipment supplier	1875	8963.96	7685.11	21822.8	8125.21	41744.53
Alibaba	E-commerce	12878	204184.6	73275.9	125997.9	170883.8	181688.6
Tencent holding	Information supplier	14000	192085.3	590682.3	992830.8	1022483.1	1225355
Netease	Information supplier	6160	112943	141862	237229	323426	729065
Baidu	Information supplier	16082	169281	443566	389688	663864	1450079
Amazon	E-commerce	56200	4306610.88	3630252.12	23395236.96	395902.02	30164471.34
Giant	Information supplier	1643	27371	56006	25725	87997	179222

Because of the DEA model is homogeneity, all financial data we selected is relates to end of year accounts. Two models implemented in this paper are the input-oriented, constant returns to scale (C^2R model) and variable returns to scale (BC^2 model), envelopment form of the DEA, which can be written as:

$$\min [\theta - \varepsilon (\sum_{i=1}^4 s_i^- + \sum_{r=1}^2 s_r^+)] \quad \min \theta_1$$

$$s.t. \begin{cases} \sum_{j=1}^{26} \lambda_j X_j + s^- = \theta X_j; \\ \sum_{j=1}^{26} \lambda_j Y_j - s^+ = Y_j; \\ \lambda_j \geq 0, j = 1, 2, L, 26; \\ s^- \geq 0; s^+ \geq 0 \end{cases} \quad \text{and} \quad s.t. \begin{cases} \sum_{j=1}^{26} \lambda_j X_j \leq \theta_1 X_j \\ \sum_{j=1}^{26} \lambda_j Y_j \geq Y_j \\ \sum_{j=1}^{26} \lambda_j = 1 \\ \lambda_j \geq 0, j = 1, 2, L, 26 \end{cases}$$

where: θ is technical efficiency; θ_1 is the Pure technical efficiency; $X_j = (X_{1j}, X_{2j}, X_{3j}, X_{4j})^T$ is the value of input for decision making unit j ; $Y_j = (Y_{1j}, Y_{2j})^T$ is the value of output for decision making unit j ; λ_j is a decision variable to be calculated from the data; s_i^-, s_r^+ is the slack variable; ε is the dimensionless.

From the DEA model we can structure an equation for every input and output and every input and output can be measured in its own units.

3. DEA Results

3.1. Cross-section Data Analysis of the Operational Efficiency

We using the financial data of 2011 to the DEA model and obtain the 26 Internet enterprises' operating efficiency. The full list results can be seen in Table 2. Table 2 shows, for each of the 26 companies, the efficiency score achieved. This score has been written in percentage values. It varies between 0% and 100%.

Table 2. The DEA Efficiencies of 26 Internet Companies

Firm	2009			2010			2011			Type
	cr	vr	se	cr	vr	se	cr	vr	se	
Wangsu Tech	0.757	0.774	0.978	0.697	0.724	0.963	0.738	0.807	0.915	Information supplier
LeTV	1	1	1	1	1	1	1.000	1.000	1.000	Information supplier
Shunwang Tech	1	1	1	1	1	1	0.963	1.000	0.963	Information supplier
TRS Tech	0.756	0.937	0.807	0.719	0.995	0.722	0.715	1.000	0.715	Communication-equipment supplier
365 NET	1	1	1	1	1	1	1.000	1.000	1.000	Information supplier
Zhangqu Tech	1	1	1	1	1	1	0.727	1.000	0.727	Information supplier
People.com.cn	1	1	1	0.888	0.935	0.95	0.908	0.912	0.996	Information supplier
263 Net	0.973	0.975	0.998	0.861	0.889	0.969	0.844	1.000	0.844	Information supplier
Datang Telecom	0.849	0.849	1	0.895	0.895	1	0.927	0.941	0.986	Communication-equipment supplier
Haihong Group	0.531	0.576	0.921	0.436	0.583	0.748	0.426	0.805	0.529	E-commerce
ZTE	1	1	1	1	1	1	1.000	1.000	1.000	Communication-equipment supplier
Shengyibao	0.659	0.706	0.934	0.673	0.679	0.991	0.774	1.000	0.774	Information supplier
Jiaodian Tech	1	1	1	1	1	1	1.000	1.000	1.000	Information supplier
Technology Co.Ltd	0.796	0.964	0.826	0.676	0.677	0.999	0.674	0.716	0.941	Information supplier
Tuwei information	0.697	0.697	1	0.68	0.682	0.996	0.584	0.590	0.990	Information supplier

Gaohong Group	1	1	1	1	1	1	1.000	1.000	1.000	Communication-equipment supplier
Beiwei Communication	0.71	0.716	0.992	0.741	0.774	0.957	0.680	0.910	0.748	Information supplier
Guomai Tech	0.639	0.644	0.992	0.678	0.691	0.981	0.782	0.787	0.993	Communication-equipment supplier
Shiji Tingli	0.961	0.986	0.975	0.838	0.877	0.955	0.611	0.641	0.954	Communication-equipment supplier
Tianyuandike	0.722	1	0.722	0.47	0.481	0.977	0.573	0.579	0.990	Communication-equipment supplier
Alibaba	0.426	0.616	0.691	0.529	0.794	0.667	0.770	0.992	0.776	E-commerce
Tencent holding	1	1	1	1	1	1	1.000	1.000	1.000	Information supplier
Netease	1	1	1	1	1	1	1.000	1.000	1.000	Information supplier
Baidu	0.735	0.902	0.816	0.978	1	0.978	1.000	1.000	1.000	Information supplier
Amazon	1	1	1	1	1	1	1.000	1.000	1.000	E-commerce
Giant	1	1	1	1	1	1	1.000	1.000	1.000	Information supplier
Average	0.854	0.898	0.948	0.837	0.872	0.956	0.798	0.872	0.905	

cr =technical efficiency from CRS DEA ; $vrste$ =technical efficiency from VRS DEA; se =scale efficiency= cr/vr .

Firstly, from the aspect of overall average efficiency, we can found: In 2011, the comprehensive efficiency of input and output of the Internet enterprise is 0.798, the average pure technical efficiency is 0.872 and the average pure scale efficiency is 0.905. All this data shows the efficiency of Internet enterprise in China is low due to the pure technical efficiency which is lower than the comprehensive efficiency. This means there still have many problems in the allocation of resources and management of the Internet enterprise in China and there have large space to improve.

Secondly, from the aspect of individual business efficiency, we also can found: There have 10 of 26 Internet enterprises is relatively effective. It means the efficiency of the whole Internet industry in China is relatively low and the value of efficiency is high and low differentiation serious. There have 15 of 26 Internet companies are effective of pure technology efficiency. This shows the technical efficiency of most Internet enterprises in China is in the best state. When the input is fixed these Internet companies' producing activity can obtain the maximal output. On the contrary there only have 10 Internet companies are effective of pure scale efficiency. It means most of the Internet enterprises in China are inefficient in the scale of the input. These companies' input and output did not reach the best proportion. It is necessary to increase or decrease a percentage of investment assets to obtain the improvement of proportion of the output.

Thirdly, from the aspect of redundancy rate of the input and output, in 2011, the average redundancy of administrative expenses of these Internet enterprises in China is 56839340 yuan. The average redundancy of employees' number is 328. The average redundancy of fixed assets is 6627900 yuan and the average redundancy of main business costs is 368960 yuan. On the contrary, in 2011, the deficit of net profits of these Internet enterprises in China is 21985360 yuan. The deficit of prime operating revenues is 82351530. All these shows in resource allocation aspect there exists serious wastes in input and the output still have considerable space for development. The Internet companies in China should speed up the adjustment of industrial structure and change the model of development to promote the steady and rapid development of the economic.

In these 26 Internet companies there have 16 companies' redundancy of resource investment in input and output is 0. This means these 16 companies achieve the relatively

effective in scale and technology aspect and there is no resource shortage or waste in input and output. But there still have 10 companies belong to resource of input exist redundancy or insufficient output style. These 10 companies did not form a positive effect in input and output. The main reasons maybe out-dated management style, idea and methods.

Fourthly, from the aspect of scale merit, 10 of 26 companies' economies of scale are invariant. 3 companies' economies of scale are diminishing. These companies should reduce the scale of assets to improve the efficiency of input and output. 16 companies belong to increasing returns to scale. These 16 companies should expand the scale and reduce the costs to increase the output.

Through the analysis we can draw a conclusion: These 16 companies' efficiency is totally ineffective and its' performance is poor. All because of these companies expand their scale recklessly and ignore the practical capacity of enterprise development. Compared with foreign advanced Internet companies, most of the Internet companies in China are still in the level of relatively backward stage with management and operation method. It will lead to many problems, such as waste of input or output can not reach the best etc. All these may become the bottleneck of development of the Internet enterprises in China.

3.2. Variance Analysis of Spatial and Temporal Pattern about the Operational Efficiency

In order to reflect the spatial and temporal or changing pattern of the operational efficiency of Internet enterprises in China, this paper select finance data of 2009 and 2010 to do dynamic evaluation of the 26 listed Internet companies. Combined with the spatial distribution and variation of operational efficiency of these companies from 2009 to 2010, the spatial distribution can be seen in Figures 1, 2, 3. Our study revealed the overall change pattern of efficiency and the influence factors about the Internet industry in China.

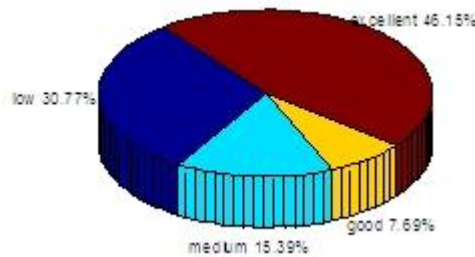


Figure 1. Plot of Distribution of Management Efficiency about 26 Listed Internet Companies in 2009

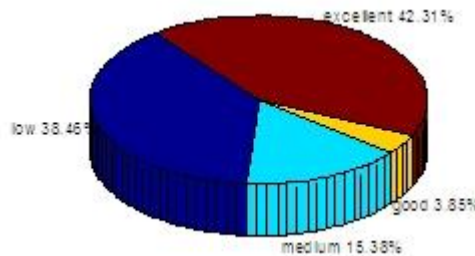


Figure 2. Plot of Distribution of Management Efficiency about 26 Listed Internet Companies in 2010

Adopt 1, 0.9, 0.75 as the boundary, the efficiency of Internet companies is divided into excellent, good, medium and low efficiency 4 kinds of situation. From the figure 1 and 2 we can find the management efficiency of the companies we selected in 2010 is decreased than in 2009.

Firstly, from the aspect of overall average efficiency, the average value of operating efficiency in 2009 is 0.854 while in 2010 is 0.837 and in 2011 is 0.798. The drop rate is 0.017 and 0.039 respectively.

Secondly, from the aspect of individual company's efficiency, there have 12 companies belong to effective style in 2009 while only 11 companies in 2010.

Thirdly, from the aspect of redundancy rate of the input, the total redundancy rate is increase from 2009 to 2010. The redundancy of X_1 , X_2 , X_3 , X_4 in 2009 is 36285010 yuan, 291 people, 30238840 yuan and 0 yuan respectively while in 2010 the corresponding redundancy is 50640240 yuan, 343 people, 3601850 yuan and 0 yuan. It means although the efficiency scale of these companies is increased, the operating efficiency of whole Internet enterprise in China is still decreased. The main reason is the decline of the technical efficiency whose droop rate is greater than rise rate.

Fourthly, from the aspect of scale merit, in 2009 there have 14 Internet companies whose returns to scale is invariant in China and 7 companies' economies of scale are diminishing. While 12 companies' economies of scale are invariant in 2010 and the number of company whose economies of scale is diminishing was reduced to 5. All these means the scale of investment is gradually increasing.

Adopt measuring range of operating efficiency (1.7%, 0, -1.7%) in 2009 and 2010 as the boundary, we divided 26 Internet listed companies into five types: significant increasing company which growth rate is greater than 1.7%, slowly rising company which growth rate is between 0 and 1.7%, invariant efficiency company which growth rate is 0, slowly decreasing company which growth rate is between -1.7% and 0, significant decreasing company which growth rate is less than -1.7%. The spatial distribution can be seen in Figure 3.

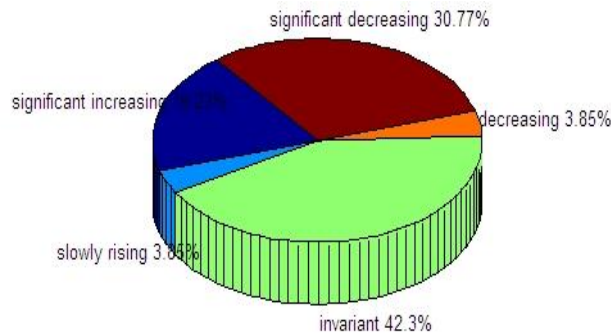


Figure 3. Plot of the Differences in Operating Efficiency of 26 Listed Internet Companies from 2009 to 2010

From Figure 3 we can find there have 8 companies' efficiency is significant decreasing. The main reason is the decline of the pure technical efficiency and extensive production. It leads to the waste of resources and low utilization rate of input. Improve techniques to improve input-output ratio is the important thing as urgent. The number of significant efficiency decreasing company is more than the significant efficiency increasing company, and this making the decline of average operation efficiency of the Internet companies in 2010.

4. Contrastive Analyses to Different Types of Internet Companies

4.1. Cross-section Data Analysis

Firstly, from the aspect of overall average efficiency, three different types of companies that belong to effective style in 2011 were listed on Table 3.

Table 3. Classification of Companies whose Efficiency were Effective in 2011

Type	No.	Proportion
Information supplier	7	43.75%
Communication-equipment supplier	2	28.57%
E-commerce	1	33.33%

Table 3 shows the numbers of companies which are belong to the type of information supplier are the most of 10 companies whose efficiency is effective. The number of companies which are belongs to the type of E-commerce is more than the type of communication-equipment supplier. All these means for different Internet companies in China there had significant differences on efficiency of input and output,

Secondly, from the aspect of pure technical efficiency, in 2011 there have 15 of 26 Internet companies in China whose pure technical efficiency is effective. The classification of these companies was listed on Table 4.

Table 4. Classification of Companies whose Pure Technical Efficiency were Effective in 2011

Type	No.	Proportion
Information supplier	11	68.75%
Communication-equipment supplier	3	42.86%
E-commerce	1	33.33%

Table 4 shows the technical efficiency of most companies that is types of information supplier are in the best state. On the contrary, the numbers of the types of E-commerce companies are the most in 11 companies which pure technical efficiency is ineffective. This means the manufacture technology is not fully applied in this type of Internet companies. There also have big development space in these companies.

Thirdly, from the aspect of redundancy rate of the input, there have 16 listed Internet companies whose redundancy of input and shortage of output is 0. The classification of these companies was listed on Table 5.

Table 5. Classification of Companies whose Redundancy of Input and Shortage of Output were 0

Type	No.	Proportion
Information supplier	12	75%
Communication-equipment supplier	3	42.85%
E-commerce	1	33.33%

Table 5 shows most type of information supplier companies is DEA effective on scale and technology. There have 10 of 26 listed Internet companies exist the problem of

shortage of output or redundancy of input. The classification of these 10 companies was listed on table 6.

Table 6. Classification of 10 Companies whose Redundancy of Input or Shortage of Output were not 0

Type	No.	Proportion
Information supplier	4	25%
Communication-equipment supplier	4	57.14%
E-commerce	2	66.67%

It shows most information supplier companies have high efficiency in terms of input, and these companies should increase their output accordingly. For example, don't need to increase the input, Datang Telecom (*ST Datang, 600198) can increase their net profits of 248215820 yuan if they improve their production or management technology.

There also have 5 Internet companies that have the problems of redundancy of input and shortage of output at the same time. For example, Alibaba Group is the famous E-commerce company in China. In 2011, if it can reduce the administration expenses from 2041846000 yuan to 1427771060 yuan, reduce the number of employee from 12878 to 8848, reduce the main business costs from 1259979000 yuan to 11068940 yuan, the input of Alibaba Group is no redundancy. Accordingly, Alibaba Group should make the prime operating revenues an increase of 2063360120 yuan on the basis of 1816886000 yuan at the present of input, the output of Alibaba Group is no shortage. Then the input and output of Alibaba Group will reach DEA effective at this situation.

Fourthly, from the aspect of pure efficiency of scale, there have 10 of 26 listed Internet companies is effective on scale in 2011. The classification of these effective companies was listed on Table 7.

Table 7. Classification of 10 Companies whose Pure Scale Efficiency were Effective in 2011

Type	No.	Proportion
Information supplier	7	43.75%
Communication-equipment supplier	2	28.57%
E-commerce	1	33.33%

From Table 7, it shows most type of communication-equipment supplier companies is ineffective on pure scale efficiency. The scale of input of this type of company is invalid and it's ratio of input and output not reach the best state.

There have 3 listed Internet companies whose economies of scale were diminishing in 2011. The classification of 3 companies was listed on Table 8.

Table 8. Classification of 3 Companies whose Economies of Scale were Diminishing in 2011

Type	No.	Proportion
Information supplier	0	0%
Communication-equipment supplier	2	28.57%
E-commerce	1	33.33%

It shows the ration of input and output of the type of communication-equipment supplier and E-commerce companies is not reach the best state. The scale of input of these companies was saturated. There is no need to increase the input because it will not increase the output. These companies should decrease the scale of assets to improve the efficiency of input and output.

4.2. Variance Analysis of Spatial and Temporal Pattern to Different Types of Internet Companies

This paper made a dynamic analysis to operating efficiency of different types of Internet companies from 2009 to 2010. It revealed the spatial and temporal patterns and influence factors of the operational efficiency of Internet enterprises in China.

Firstly, according to the standard of division in this paper, the proportion of excellent, good, medium and low efficiency of three types of Internet companies in 2009 and 2010 was listed on Table 9.

Table 9. The Proportion of Different Efficiency about Different Types of Internet Companies

Year		2009			2010		
Type		Information supplier	Communication-equipment supplier	E-commerce	Information supplier	Communication-equipment supplier	E-commerce
Efficiency	Excellent	56.25%	28.57%	33.33%	50%	28.57%	33.33%
	Good	6.25%	14.29%	0%	6.25%	0%	0%
	Medium	12.5%	28.57%	0%	12.5%	28.57%	0%
	Low	25%	28.57%	66.67%	31.25%	42.86%	66.67%

From Table 9 it shows the overall efficiency of three types of Internet companies were reduced from 2009 to 2010. Especially the type of communication-equipment supplier is the fastest decline in operating efficiency. It means the difference of management efficiency of these three types of companies was gradually expanding. The development of E-commerce companies is stable.

Secondly, according to the standard of division at the front, the measuring range of operating efficiency of three types Internet companies from 2009 to 2010 was listed on Table 10.

Table 10. The Range of Operating Efficiency of Three Types Internet Companies from 2009 to 2010

Type of efficiency Type of company	Type of	Proportion of significant increasing	Proportion of slowly rising	Proportion of invariant	Proportion of slowly decreasing	Proportion of significant decreasing	Total
Information supplier		2(12.5%)	1(6.25%)	8(50%)	1(6.25%)	4(25%)	16
Communication-equipment supplier		2(28.6%)	0	2(28.6%)	0	3(42.8%)	7
E-commerce		1(33.3%)	0	1(33.3%)	0	1(33.4%)	3
Total		5	1	11	1	8	26

From Table 9 and 10, it shows the overall operating efficiency of Internet companies is decreased by 1.7%. In 2010, two communication-equipment supplier companies that belong to significant increasing is change to excellent efficiency from low efficiency.

There have 8 Internet companies belong to type of significant decreasing and the number of company belong to type of decreasing is more than type of increasing. This lead to the decline of the average operation efficiency of Internet companies in China in 2010.

5. Conclusions

There is an application of contribution in this paper: constructs the index system of the efficiency evaluation to Internet companies in China. Based on the economic data from 2009 to 2011 and Data Envelopment Analysis (DEA), vertical and horizontal comparison to operating efficiency of different types of Internet companies is proposed.

Data for a sample of 26 listed Internet companies have been analyzed. Inputs have taken the form of assets, human resources (number of employees), and expenditure. Two very different outputs have been included in the model: net profits, and prime operating revenues. Efficiency scores have been calculated that contains all inputs and outputs. Three types of Internet companies in China have been examined. It has been shown that there are significant differences between these companies. Our conclusion is as follows:

Firstly, the overall performance of Internet industry in China is at a low level. There is a serious difference between high and low value of efficiency. The main reason lead to this difference is the low level of pure technical efficiency. This is means there are still many problems in the allocation of resources and management in the Internet industry in China. It has a big space to improve the efficiency of these companies.

Secondly, several figures have been produced. Through these figures we concluded that, the type of communication-equipment supplier's company is lowest effectiveness of three types of Internet companies. The main reason of it is the inefficient of the scale. The scale of expenditure of this type of Internet companies is unreasonable, and the ratio of input-output is not reach the optimal proportion. The low level of scale efficiency is the main reason lead to the inefficiency of the type of information supplier's companies. Production technology is makes a full use in the output and various input is used completely of this type of company. On the contrary, the production technology is not fully used in the output of the type of E-commerce companies. There have all kinds of waste in input of this type of company.

Thirdly, the overall operating efficiency of whole Internet industry in China is decreasing the main reason of it is the decline of the pure technical efficiency. The extensive production leads to the waste of resources and the low utilization rate of input.

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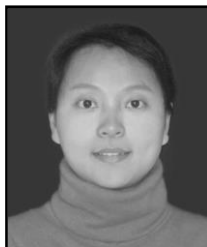
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