The Productivity of Listed Companies of Computers and Related Equipment Manufacturing Industry

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***Abstract*—Indicators system of China's computer manufacturing enterprises of listed companies in Shanghai and Shenzhen can be established to reflect the efficiency of production, which accord to the number of employees, fixed assets and other economic data. Integrated data envelopment analysis (DEA) models are used, combining with evaluation and statistical tests of Synthetic Average method, Borda method, Copeland method and Fuzzy Borda method (SABCB Method). The productivities and returns to scale (RTS) of these computer companies can be figured out. Some results could be obtained through the empirical analysis: firstly, productivities of China's computer manufacturers are acceptable in general, although there are still great differentiations among them; secondly, due to the lack of outputs, RTS in some enterprises are decreasing; thirdly, it is currently urgent task that most of computer manufacturers continue to refine and deepen specialization transform existing business processes.**

***Index Terms*—computer manufacturing enterprise, productivity, data envelopment analysis, SABCB method**

I. Introduction

Since IBM in the United States had introduced a module-based computer (IBM/360) system in 1964, modular production methods of computer manufacturing industry has begun to replace the large-scale production gradually. Under this new production mode, computer system is broken down into different aspects, such as hardware, chips, operating systems, application software, assembly, sales and others, which are completed by different sectors. The change of production mode provides an opportunity for China and other developing countries, by which they entry the global computer manufacturing industry chain [1].

Rapid development of manufacturing industry of computers and related equipment (referred to as computer manufacturers) have a great strategic significance for improving productivity comprehensively of economy and society, promoting optimization of economic structure, pushing transition of economic growth mode and realizing sustainable development. Therefore, it is necessary to commence the study which focuses on how to improve the productivity of the computer manufacturing enterprises. Through fostering their sustainable competitive advantage, we try to seek lasting powers of promoting sound and rapid development in computer manufacturing industry. International competition is becoming increasingly fierce in the current. If both the outdated mode of computer manufacturing industry and the productivity can not be improved continually, it is bound to become increasingly struggling in the long run. It is the only way for computer industry in China that the promotion of productivity is taken as a direction.

Characteristics of computer products structure expand the space of module production, which make it one of the most globalization industries and attributable to global procurement, global production, and global distribution of this industry [2]. However, computer manufacturing industry in China is still in initial stage compared to developed countries. Economic theory and empirical research concerning computer manufacturers are still very limited and lack adequate depth and breadth. Therefore, how to reveal the micro-mechanism of the development of productivity and make studies on the competitiveness of computer industry, by which these can look into ways to reduce input redundancy and avoid output shortage in computer manufacturing company and to attract investment in this industry actively, will be an important issue China's scholars are facing.

Enhancement of productivity not only need scientific and technological innovation, but also need the establishment of a practical evaluation system to assess it. It is believed that a comprehensive analysis of micro-scale is an important way to setting a conditionally complete and operable evaluation of computer manufacturer productivity. Meanwhile, it is needed to improve and integrate comprehensive evaluation method, view productivity as a complex system, consider the interaction of multi-level factors and evaluate the effectiveness and feasibility of the system through empirical validation. It is a fundamental way to carry out comprehensive evaluation of productivity for computer manufacturers.

II. Evaluation Index System of Productivity

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Data Envelopment Analysis (DEA) is one of the best quantitative methods that carry out productivity evaluation. Put forward by Charnes, Coopor and Rhodes (1978), through the continuous development and improvement by many scholars all over the world for 31 years, it has become a collection of methods which measure relative efficiency (Data-oriented) of multi-input and multi-output decision making units (DMU) [3]. Quite a few scholars in China (Zhaohan Sheng, 1996; Quanling Wei, 2004) thought that the homogeneity of DMUs requests all entities which constitute a group of DMUs have the same goals or tasks, the same external environment, the same input & output indicators and the same dimension [4-5]. Manufacturers are in line with the requirements as the DMU units, while the productivity is subject to the dynamic effects by some different factors and these factors are not only in constantly changing, but also influent and constrain each other. How to build an indicator system securely according to these factors is very important because different indicators result in different effects to evaluation (Weihua Su, 2001) [6]. Under such circumstances, the choice of indicators is critical to evaluate the productivity, economic scale and structure of computer manufacturers.

The comprehensive evaluation index system that analysis requires is designed in this paper. Among input indicators fixed assets, as the physical form of fixed capital, play a long-term effect on the production process and reflect the overall strength of enterprise; liquid assets are also the essential component of enterprise' assets; staff salaries mainly explain actual wages paid to employees and other cash payments for workers; administrative expenses primarily are spent in organizing and managing enterprise by the administration departments, reflecting the level of its management; finance costs are spent in raising production and operation, reflecting financing capacity and debt structure of it. In the output indicators, total profit is a very important economic indicator which could measure the enterprise performance; net income from investments is the net of business investment income minus investment losses; to corporate investor, it is the basic elements of getting the return on investment; as for the managers, it is a basis for management decision-making. Considering the ability of discriminating feature differences in evaluation indicators and objects, it is the key to distinguish the strength of productivity in different samples; if all samples were scored in a near-unanimous evaluation index, the evaluation index would not have the ability to identify and the degree of strength of productivity would not be determined. Therefore, standard deviation coefficient is used to identify the evaluation:

$$v_\sigma = \frac{\sigma}{\bar{x}} \times 100\%$$

In the formula, σ is standard deviation of the sample, $\bar{x}$ is arithmetic mean of the sample. According to calculations, the absolute values of standard deviation coefficient in the various indicators over the years are relatively large (≥1). So the indicator system is reasonable. The results can be seen in table I.

TABLE I.
INDEX SYSTEM OF COMPUTER MANUFACTURERS' PRODUCTIVITY

Index Type	Index Name	Indicators Code	Standard Deviation Coefficient
Input indicators	Liquid Assets	(I)LDZC	1.51
	Fixed Assets	(I)GDZC	1.50
	Staff Salaries	(I)ZGXC	1.96
	Management Costs	(I)GLFY	1.45
	Finance Costs	(I)CWFY	1.78
Output Indicators	Total Profit	(O)LRZE	2.46
	Net Income From Investments	(O)TZSY	2.62

III. QUANTITATIVE ANALYSIS BY INTEGRATED DEA MODELS

In this article data of 7 indicators are collected which include 5 inputs and 2 outputs data as the evaluation sample of computer manufacturers. These data come from 18 computer manufacturers, computer-related equipment manufacturers and computer repair companies in 2008. Different DEA models are used to measure comprehensive scores of productivity of these enterprises respectively.

CCR model, being non-parametric data envelopment analysis method, which was applied to estimation frontier, is the most basic and important technology of DEA model classes [3]. Banker, Charnes and Cooper (1984) proposed an expanded model of fixed-scale DEA, taking variable returns to scale (VRS) case into account, which means that if not all the DMUs run in the best size, the measurement of technical efficiency would be affected by Scale efficiency (SE). VRS model allows the calculation of technical efficiency away from the effects of RTS, which is one of Banker-Charnes-Cooper (BCC) models [7]. By analyzing the characteristics of 18 listed companies in different segments, taking into account the status quo among them, as well as unfair competition from external, financial constraints, which may lead to the failure of some DMUs'operation in optimal size, BCC model and its extended models of VRS are used (VRS) as integrated assessment models. These models include input-oriented BCC-I model, output-oriented BCC-O model, super-efficient BCC-I model and super-efficient BCC-O model. BCC-I and BCC-O model can give results of RTS of DMUs. There are three results when the DMUs are in the BCC model. When θ_0=1, RTS is constant; When θ_0 <1 and

$$\frac{1}{\theta_0}\sum_{j=1}^{n}\lambda_j^0 > 1$$

RTS is decreasing; When θ_0>1 and

$$\frac{1}{\theta_0}\sum_{j=1}^{n}\lambda_j^0 < 1$$

RTS is increasing [8].

Super-efficiency DEA has an advantage in the comprehensive evaluation. (Andersen & Petersen, 1993) [9], so this paper selected two super-efficient models from extended BCC models.

The requirements of data format and calculation in BCC and its expansion model are identical to CCR, the basic model of DEA. Data are from Genius Finance Database. Due to some negative indicator data in financial costs, total profits and other indicators, so a non-dimensional raw data processing is conducted. x_i represents the actual value; x_{max} represents the max value of indicator; x_{min} represents the min values of indicator; $x_i^{'}$ represents Corresponding values after the non-dimensional treatment of x_i; then

$$x_i' = 0.1 + 0.9 \times \frac{x_i - x_{\min}}{x_{\max} - x_{\min}}$$

Range of values of $x_i^{'}$ after non-dimensional treatment is from 0.1 to 1, as shown in table II. Ranks and specific score values according to above four ways are shown from table III to table VI. RTS is showed in table VII.

TABLE II.
THE DATA AFTER STANDARDIZING

Company Name	(I)LDZC	(I)GDZC	(I)ZGXC	(I)GLFY	(I)CWFY	(O)LRZE	(O)TZSY
CCXX	0.16	0.14	0.21	0.17	0.19	0.47	0.57
LCXX	0.16	0.16	0.12	0.18	0.16	0.43	0.57
STHX	0.14	0.17	0.11	0.12	0.31	0.10	0.10
STLG	0.12	0.13	0.15	0.12	0.24	0.25	0.51
ZDGT	0.19	0.14	0.12	0.17	0.40	0.47	0.63
SDJT	0.17	0.19	0.11	0.16	0.27	0.54	0.42
QDRK	0.22	0.19	0.12	0.20	0.20	0.59	0.51
HTXX	0.37	0.29	0.98	0.51	0.10	1.00	0.66
CCKF	0.29	0.40	0.30	0.22	0.19	0.64	0.79
ZGGF	0.18	0.14	0.12	0.16	0.34	0.45	0.75
DFDZ	0.17	0.22	0.13	0.23	0.17	0.44	0.53
STCH	0.10	0.10	0.10	0.10	0.18	0.40	0.51
TFGF	1.00	1.00	1.00	1.00	1.00	0.75	1.00
TGTC	0.16	0.12	0.11	0.13	0.28	0.43	0.51
HDDN	0.15	0.10	0.20	0.14	0.19	0.43	0.52
CCDN	0.18	0.23	0.18	0.19	0.34	0.42	0.81
STXZ	0.11	0.10	0.10	0.11	0.19	0.42	0.51
FZKJ	0.29	0.69	0.11	0.32	0.43	0.53	0.54

Resources of data: calculation of data according to Genius Financial Database.

TABLE III.
RESULTS MEASURED BY BCC-I DEA MODEL

DMU	Score	Excess LDZC S-(1)	Excess GDZC S-(2)	Excess ZGXC S-(3)	Excess GLFY S-(4)	Excess CWFY S-(5)	Shortage LRZE S+(1)	Shortage TZSY S+(2)
CCXX	0.99	0.01	0.00	0.02	0.00	0.00	0.00	0.00
LCXX	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STHX	0.91	0.03	0.05	0.00	0.01	0.10	0.30	0.41

STLG	0.83	0.00	0.01	0.02	0.00	0.02	0.15	0.00
ZDGT	0.98	0.02	0.00	0.00	0.01	0.13	0.00	0.00
SDJT	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
QDRK	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HTXX	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CCKF	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZGGF	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DFDZ	0.95	0.00	0.05	0.00	0.04	0.00	0.00	0.04
STCH	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TFGF	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TGTC	0.92	0.03	0.00	0.00	0.00	0.06	0.00	0.00
HDDN	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CCDN	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STXZ	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FZKJ	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Resources of data: using BCC-I DEA to calculate the data according to Genius Financial Database.

TABLE IV.
RESULTS MEASURED BY BCC-O DEA MODEL

DMU	Score	Excess LDZC S-(1)	Excess GDZC S-(2)	Excess ZGXC S-(3)	Excess GLFY S-(4)	Excess CWFY S-(5)	Shortage LRZE S+(1)	Shortage TZSY S+(2)
CCXX	0.99	0.01	0.00	0.02	0.00	0.00	0.00	0.00
LCXX	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STHX	0.22	0.02	0.04	0.01	0.00	0.10	0.00	0.03
STLG	0.88	0.00	0.01	0.03	0.00	0.02	0.12	0.00
ZDGT	0.99	0.02	0.00	0.00	0.01	0.13	0.00	0.00
SDJT	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
QDRK	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HTXX	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CCKF	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZGGF	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DFDZ	0.94	0.00	0.05	0.00	0.05	0.00	0.00	0.00
STCH	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TFGF	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TGTC	0.95	0.02	0.00	0.00	0.00	0.07	0.00	0.00
HDDN	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CCDN	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STXZ	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FZKJ	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Resources of data: using BCC-O DEA to calculate the data according to Genius Financial Database.

TABLE V.
RESULTS MEASURED BY SUPER BCC-I DEA MODEL

DMU	Score	Excess LDZC S-(1)	Excess GDZC S-(2)	Excess ZGXC S-(3)	Excess GLFY S-(4)	Excess CWFY S-(5)	Shortage LRZE S+(1)	Shortage TZSY S+(2)
CCXX	0.99	0.01	0.00	0.02	0.00	0.00	0.00	0.00
LCXX	1.16	0.05	0.03	0.00	0.08	0.00	0.02	0.00
STHX	0.91	0.02	0.05	0.00	0.00	0.09	0.32	0.41
STLG	0.83	0.00	0.01	0.03	0.00	0.02	0.15	0.00
ZDGT	0.98	0.02	0.00	0.00	0.01	0.13	0.00	0.00
SDJT	1.10	0.00	0.05	0.00	0.00	0.10	0.00	0.09
QDRK	1.71	0.17	0.09	0.00	0.15	0.10	0.00	0.00
HTXX	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CCKF	1.87	0.20	0.40	0.03	0.02	0.00	0.00	0.00
ZGGF	1.47	0.08	0.00	0.00	0.05	0.15	0.00	0.00
DFDZ	0.95	0.00	0.05	0.00	0.04	0.00	0.00	0.04
STCH	1.10	0.00	0.01	0.01	0.00	0.01	0.02	0.00
TFGF	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TGTC	0.92	0.03	0.00	0.00	0.00	0.06	0.00	0.00
HDDN	1.04	0.04	0.00	0.09	0.03	0.00	0.00	0.00
CCDN	2.00	0.00	0.02	0.00	0.08	0.38	0.21	0.00
STXZ	1.09	0.00	0.00	0.00	0.01	0.02	0.00	0.00
FZKJ	1.05	0.12	0.56	0.00	0.16	0.23	0.00	0.00

Resources of data: using SUPER BCC-I DEA to calculate the data according to Genius Financial Database.

TABLE VI.
RESULTS MEASURED BY SUPER BCC-O DEA

DMU	Score	Excess LDZC S-(1)	Excess GDZC S-(2)	Excess ZGXC S-(3)	Excess GLFY S-(4)	Excess CWFY S-(5)	Shortage LRZE S+(1)	Shortage TZSY S+(2)
CCXX	0.99	0.01	0.00	0.02	0.00	0.00	0.00	0.00
LCXX	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STHX	0.22	0.02	0.04	0.01	0.00	0.10	0.00	0.03
STLG	0.88	0.00	0.01	0.03	0.00	0.02	0.12	0.00
ZDGT	0.99	0.02	0.00	0.00	0.01	0.13	0.00	0.00
SDJT	1.07	0.00	0.03	0.00	0.00	0.07	0.00	0.12
QDRK	1.25	0.05	0.01	0.00	0.03	0.00	0.00	0.11
HTXX	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CCKF	1.27	0.10	0.21	0.05	0.00	0.00	0.00	0.00
ZGGF	1.22	0.01	0.00	0.00	0.00	0.00	0.08	0.00
DFDZ	0.94	0.00	0.05	0.00	0.05	0.00	0.00	0.00
STCH	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TFGF	1.26	0.73	0.63	0.72	0.79	0.78	0.00	0.00
TGTC	0.95	0.02	0.00	0.00	0.00	0.07	0.00	0.00
HDDN	1.02	0.04	0.00	0.10	0.03	0.00	0.00	0.00
CCDN	1.08	0.00	0.09	0.06	0.03	0.00	0.06	0.00

STXZ	1.05	0.01	0.00	0.00	0.01	0.01	0.00	0.02
FZKJ	1.05	0.13	0.55	0.00	0.17	0.23	0.00	0.00

Resources of data: using SUPER BCC-O DEA to calculate the data according to Genius Financial Database.

TABLE VII.
RETURNS TO SCALE OF EACH ENTERPRISES CALCULATED BY BCC DEA MODELS

Model	DEA BCC-I Model		DEA BCC-O Model	
RTS	RTS	RTS of Projected DMU	RTS	RTS of Projected DMU
CCXX		Decreasing		Decreasing
LCXX	Constant		Constant	
STHX		Constant		Decreasing
STLG		Constant		Decreasing
ZDGT		Decreasing		Decreasing
SDJT	Constant		Constant	
QDRK	Constant		Constant	
HTXX	Constant		Constant	
CCKF	Constant		Constant	
ZGGF	Constant		Constant	
DFDZ		Constant		Constant
STCH	Constant		Constant	
TFGF	Decreasing		Decreasing	
TGTC		Increasing		Decreasing
HDDN	Constant		Constant	
CCDN	Decreasing		Decreasing	
STXZ	Constant		Constant	
FZKJ	Constant		Constant	

Resources of data: using BCC DEA models to calculate the data according to Genius Financial Database.

It can be seen from the tables that although productivities of these computer manufacturers are acceptable in general, there are great differentiations among them, being still much room for growth in some companies. Even in the condition of Industry Promotion of computer industry, there is still a trend of decreasing RTS in many enterprises; output shortage and input redundancy are also existed in most enterprises. According to the calculation of BBC-I model, the number of decreasing RTS of companies is 4; according to the calculation of BBC-O model, the number of decreasing RTS of companies is 7. These phenomena illustrate that the improvement of efficiency is still a pressing task for computer manufacturers in the process of promoting productivity. The revitalization of computer industry not only requires the implementation of refining and deepening specialization in related businesses and transformation of existing business processes. Governments should also take further measures to promote the productivity of computer manufactures to help these computer companies become bigger and stronger.

In the period of economic transition in China, the computer enterprises must strive to improve their productivities constantly and avoid decreasing RTS through management innovation.if they hope to survive the competitive process of market economy, Management departments of this industry should adopt effective measures to help inefficient enterprises, including a series of development plans for computer industries and support for relatively weak enterprises under the framework of market economy, which can promote good and fast development of computer industry.

IV. ANALYSIS OF SYNTHETIC AND INTEGRATED APPROACH

Through scientific computing and ranking of composite scores, related companies can not only see strengths and advantages of theirs, but also identify gaps and deficiencies, by which they can promote their self-pressure to speed up development and dynamically track and study the development law of highest-ranked computer manufacturers. This could provide advice for enterprises and a basis for policy formulation of government departments. However, due to different emphases in the above-mentioned DEA-BBC model, results and rankings are different. So the comprehensive and integrated approach is used to probe the results of them.

A. SABCB Measurement

In order to resolve the inconsistency of multi-method evaluation, many scholars have used a variety of methods to establish an integrated portfolio. Meantime, different integrated methods have different values of evaluation, which created new inconsistencies. To solve this problem, it is needed to determine which is more effective in certain circumstances (Yajun Guo, 2009) [10]. The relative effectiveness of the indicators which are calculated by a single DEA model is inadequate when it evaluates DMUs (Liping Wang, 2008) [11]. In order to achieve the complementary advantages by the use of objective and subjective empowerments to achieve more reasonable and scientific evaluation results, this paper utilize Synthetic Average method, Borda method, Copeland method and Fuzzy Borda method (SABCB method) to evaluate the results of BCC and its extend models, by which evaluation value is measured. It can be seen in table VIII.

TABLE VIII.
RESULTS OF SABCB METHODS

Integrated method	Synthetic Average method		Borda method		Copeland method		Fuzzy Borda method	
Company Name	Score	Rank	Score	Rank	Score	Rank	Score	Rank
CCXX	18.01	6	12	5	7	6	153.18	6
LCXX	17.96	12	0	7	-13	11	152.68	11
STHX	18.44	1	16	1	16	1	157.38	1
STLG	18.15	2	16	1	16	1	155.21	2
ZDGT	18.02	5	12	5	8	5	153.24	5
SDJT	17.96	13	0	7	-13	11	152.51	13
QDRK	17.76	16	0	7	-16	15	149.35	16
HTXX	18.00	7	0	7	-9	7	153.00	7
CCKF	17.72	18	0	7	-17	17	148.37	17
ZGGF	17.83	15	0	7	-15	14	150.61	15
DFDZ	18.06	4	14	3	12	3	153.99	4
STCH	17.98	9	0	7	-13	11	152.83	9
TFGF	17.94	14	0	7	-16	15	151.61	14
TGTC	18.07	3	14	3	12	3	154.04	3
HDDN	17.99	8	0	7	-10	8	152.85	8
CCDN	17.73	17	0	7	-17	17	148.26	18
STXZ	17.97	11	0	7	-12	9	152.62	12
FZKJ	17.98	9	0	7	-12	9	152.69	10

Resources of data: according to table III to table VI.

B. Test of Results

Because the integrated evaluation was set up on the basis of single evaluation results, its scientific rationality directly depends on the rationality of these single evaluation results. It is needed to test these groups of evaluation results and decide their consistency. When the original methods have the consistency, the integrated assessment methods are effective. Thus, their consistencies must be checked before integrated evaluation methods are applied. If there are a variety of results, Kendall consistency coefficient is needed to test them. The results show that the Kendall's W coefficient of evaluation results is 0.934, which means the null hypothesis can be rejected [10]. So results of four kinds of evaluation methods are consistent. The results of test can be seen in table IX. So, integrated comprehensive ranks are selected as the final results, as is shown in table X.

TABLE IX.
RESULTS OF KENDALL'S W TEST

N	4
Kendall's W	0.934
Chi-Square	63.53
df	17
Asymp. Sig.	0

Resources of data: calculated by SPSS 17.0 Software.

TABLE X.
FINAL RESULTS

Company Name	Ranking	Company Name	Ranking
CCXX	6	ZGGF	15
LCXX	12	DFDZ	4
STHX	1	STCH	10
STLG	2	TFGF	14
ZDGT	5	TGTC	3
SDJT	13	HDDN	8
QDRK	16	CCDN	18
HTXX	7	STXZ	11
CCKF	17	FZKJ	9

Resources of data: calculated according to Table VIII.

V. CONCLUSIONS

First of all, through establishing the evaluation index system of productivity in computer manufacturing enterprises and incorporation of productivity into comprehensive evaluation system, the main content of appraisement and evaluation of leaders of computer manufacturers are put into system, which are important institutional guarantee for enhancing corporate social responsibility and confirming the change of the economic growth modes of entire computer industry. Secondly, we should establish evaluation index system scientifically through following the principles that combine systematic and unique, static and dynamic evaluations; some innovation indicators, integrated indicators and system indicators then are explored which could analyze the essential characteristics of productivity. Thirdly, it is necessary to verify the comprehensive evaluation results of productivity of computer manufacturers by the use of multiple methods of comparison and analysis, including comparison with other studies, comparison among some different methods as well as comparison of actual effects, to establish a dynamic evaluation system.

Therefore, how to innovate integrated DEA evaluation methods, by which an integrated evaluation and an improved exploratory Panel Data model are used to build productivity evaluation index system of computer manufacturers and set dynamic change indicators, to keep the entire evaluation system changing constantly, format a set of more comprehensive evaluation system, and it is important to change ex-post evaluation into pre-assessment, combining Monte Carlo with DEA and other methods. Meanwhile, the simulation of economic policy for computer manufacturing industry's revitalization, taking advantage of PPS sampling techniques to control simulation error, will be the issue that need to be studied in the future.

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