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# A Study on the Operating Efficiency of Small and Medium-sized IC Companies in China

Tian-Jiao Guo[1] , Jun-Won Yang[2], Hyung-Ho Kim[2*]
[1]Professor, Faculty of Information Engineering, Jilin Engineering & Normal University
[2]Professor, Dept. of Air Transport & Logistics, Sehan University

# 중국 중소 IC 회사의 운영 효율성에 관한 연구

곽천교[1], 양준원[2], 김형호[2*]
[1]길림공정기술사범학원 정보공학부 교수, [2]세한대학교 항공교통물류학과 교수

**Abstract** The purpose of this paper is to investigate various factors affecting the efficiency of China IC industry, reflecting the resource utilization and overall development level of China IC industry. In this paper, three input indicators (R&D Expenditure, Cash paid to and for employees, Total fixed assets) and two output indicators (Net profit, Sales revenue) were selected for 17 listed companies in the IC industry with operating profit of less than 1 billion yuan in 2018 and applied the technology efficiency theory and DEA analysis method to analyze the relative efficiency of the output base. The study found that one of the 17 companies analyzed was efficient, two were inefficient on an inadequate scale, and the rest were inefficient due to insufficient production technology, scale and management level. This study argues that enterprises should reduce resource input appropriately and strengthen scientific and technological innovation management to maximize resource utilization efficiency. Therefore, this study has important practical significance for improving the efficiency of IC enterprises. The Malmquist method will be used to study the total factor productivity of small and Medium-sized companies in IC industry.

**Key Words :** IC Industry, Technical Efficiency, DEA, CCR, BCC

**요 약** 본 논문의 목적은 중국 IC 산업의 자원 활용과 전반적인 개발 수준을 반영한 중국 IC 산업의 효율성에 영향을 미치는 다양한 요인을 조사하기 위한 것이다. 본 논문에서는 2018년 영업이익이 10억 미만인 IC산업 상장기업 17개사를 대상으로 3개의 입력지표(R&D 지출, 종업원에게 지급된 비용, 고정자산 총액)와 2개의 출력지표(순이익, 판매수익)를 선정하고 기술효율성 이론과 DEA 분석법을 적용하여 아웃풋 기반 상대적 효율성을 분석하였다. 연구결과, 분석대상 17개 기업 중 1개사는 효율적이고, 2개사는 부적합한 규모로 비효율적이며, 나머지는 생산기술과 규모, 경영수준이 미흡해 비효율적이라는 것을 파악하였다. 본 연구의 시사점은 중국의 중소 IC기업은 투입 자원을 적절히 축소하고, 기술혁신 관리를 통해 자원 활용의 효율성을 높여야 함을 제시한 것이다. 향후 맘퀴스트 분석을 통해 중국 중소 IC 회사의 동적 효율성 분석을 실시할 필요가 있다.

**주제어 :** IC산업, 기술 효율성, DEA, CCR, BCC

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*Corresponding Author: Hyung-Ho Kim(hhkim@sehan.ac.kr)
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## 1. Introduction

IC industry is the core foundation of the information age. It is one of the high-tech industries that have developed rapidly in recent decades. China has raised the development of integrated circuit industry to the level of national strategy, which has injected huge energy into the industrial development from both policy and capital. With the independent innovation and development of integrated circuit industry, its market scale and enterprise competitiveness will be continuously improved. According to the statistics of WSTS, the global semiconductor market basically maintained the growth momentum in 2018, with the market scale reaching 477.94 billion us dollars, with a year-on-year growth of 15.9%, which slowed down from the significant growth of 21.6% in 2017. The IC industry, while not always growing, has followed a spiral over the past decade, slowing or declining before experiencing a more robust recovery. Behind this is the growth brought by the scientific and technological revolution. Along with the wider popularization and intelligentization of electronic products in human life, the future IC industry will still maintain vigorous vitality and spiral upward. At present, the semiconductor industry is at the beginning of a rising period. IC industry is capital intensive, technology intensive industry. The design and development of a chip need to spend 1-2 years or even longer, the enterprise needs to invest a lot of manpower, material and financial resources. IC product technology and manufacturing technology is difficult, the technology research and development cycle is long, which requires a long time of technology accumulation, short time of explosive growth is difficult to achieve technology catch up. According to the annual report disclosed by global semiconductor enterprises, the annual capital expenditure level of global semiconductor enterprises is 70 billion us dollars, and the research and development expense is 50 billion us dollars. Constrained by Moore's law, every manufacturer will continue to promote innovation, and the investment level of IC industry has been breaking through higher levels in recent years. Of course, companies make Capital expenditure plan based on sales, and future industry sales will continue to grow, suggesting that industry capital expenditure will continue to grow. However, some enterprises will face great pressure due to low sales volume and limited investment. Therefore, it has become a top priority to study how to increase the operating income of enterprises. Based on a large number of preliminary studies and DEA research method, this paper identified listed companies in China's IC industry with annual operating revenue of less than 1 billion in 2018 as research samples to explore the development and change of efficiency of small and medium-size enterprise in this industry. Combined with the international IC industry process and market competition situation, this paper comprehensively considers, screens the valuable input and output and the influential factors measurement index, establishes the model to carry on the empirical analysis. In addition, through investigating various factors affecting the efficiency of this industry, this paper reflects the resource utilization and overall development level of the this industry, and then makes an overall evaluation of the efficiency of the industry, and puts forward reasonable Suggestions on the improvement of the efficiency of the industry and the optimization of its structure. This is not only conducive to relevant institutions to understand the current industry development trend and dynamics, but also conducive to timely grasp the industry market and process competition in important areas and important characteristics, so as to provide theoretical support for the development of China's IC industry.

## 2. Theoretical Background and Literature Review

### 2.1 Theoretical background

This paper is based on the theory of technical efficiency. S. P. MAO. believed that technical efficiency appeared with the study and measurement of technological progress. Technical efficiency reveals the relationship between technical progress, technical popularization and economic growth. From the perspective of growth source, the growth of product output is the result of the improvement of factor productivity and the increase of factor input, while the improvement of factor productivity is attributed to the improvement of technical efficiency and the role of technological progress[1]. Technical efficiency refers to the optimal allocation state between input and output factors. The concept of technical efficiency was first proposed by Farrell(1957). He gave the definition of technical efficiency from the perspective of input, believing that technical efficiency refers to the ratio between the ideal minimum possible input of production unit and the actual input under the same output. Although Farrell's theory of technical efficiency is generally accepted by the academic community, his research method is defective. In 1966, Leibentein made a new definition of the concept of technical efficiency from the perspective of output, believing that technical efficiency is the percentage of the actual output and the maximum output that can be achieved when the market price, investment scale and factor proportion remain unchanged. This technical efficiency defined in terms of output is generally accepted and is the most used in applied research. Lau and Yotopoulos (1971, 1973) put forward the concept of relative economic efficiency. Relative economic efficiency is composed of relative technical efficiency and relative price (configuration) efficiency. If an enterprise earns a higher profit than another enterprise, it has a higher price efficiency. According to Noel. D. Uri. (2003), technical efficiency refers to the proportion that actual input can save compared with the most effective input at the same output level. According to Y. M. Wu. (2004), technical efficiency is used to measure the capacity of the producer to obtain the maximum output under the existing technology level, indicating the degree to which the producer's production activities are close to its frontier (maximum output), reflecting the development degree of the existing technology[2]. The essence of the above definition is the same. From the perspective of output, technical efficiency refers to the ratio between the actual output of economic unit and the ideal output (the maximum possible output) under the same input. From the perspective of input, technical efficiency refers to the ratio between the ideal input (the least possible input) and the actual input under the same output. The technical efficiency is the production of the actual value and the optimal value (maximum output or minimum cost), it is used to measure economic unit for maximum output (or input minimum cost) ability, say economic unit close to the actual production of the frontier (the production of the optimal value of output or cost), can effectively reflect the extent to which economic unit of existing technology.

### 2.2 Literature review

For the study of industrial efficiency, scholars mainly analyze the technical efficiency theory and research methods. Among them, Z. W. Cao. believes that technical efficiency is accompanied by the research and measurement of technological progress. Technical efficiency reveals the relationship between technical progress, technical popularization and economic growth. Measurement

of technical efficiency is of great significance in the field of economy and management[3]. Q. S. Lin. and S. Li. believe that enterprise management is a direct link that affects enterprise efficiency[4]. James o. (2007) used DEA method to analyze the enterprise efficiency and made an in-depth analysis of the efficiency growth[5]. Y. Jin. believes that strengthening the regulation of local governments from the system and preventing the excessive increase of administrative fees of local governments will help to improve the regional differences in the technical efficiency of the public sector [6]. Lorenzo etc. believe that DEA model can go deep into the decision-making unit to evaluate the efficiency of subsystems and find out the problem of low efficiency, but the difficulty lies in the difficulty in determining the allocation weight of initial input[7]. Z. W. Wang. used DEA-Malmquist index model to conduct TFP analysis of IC industry in 30 provinces and cities in China, and concluded that there was a big gap in input and output capacity of IC and related industries among provinces and cities in China[8]. W. X. Chen. used DEA method to study the technological innovation ability of China's integrated circuit industry, and believed that r&d investment is the most important factor to promote the technological innovation of integrated circuit industry, and patent application and authorization are effective ways to protect the technological innovation achievements[9] Y. Y. Sun. used DEA method to study the performance evaluation of IC industry listed companies in China[10]. Taking the semiconductor lighting industry as an example, X. Xiao. combined with DEA analysis method to discuss the competitive advantage and development mode of the high-tech industry in east and central China[11]. S. Q. Qian. and Y. J. MAO. established the DEA-Kmeans evaluation framework of financial efficiency, and made a comprehensive financial evaluation of listed semiconductor display devices companies, providing reference for dynamic management and decision support of enterprises from the financial perspective[12]. X. S. Tan. believes that how to reasonably allocate resources, improve the marginal remuneration and improve the investment efficiency of resources invested by various enterprises is very critical for both the country and enterprises[13]. From the perspective of resource allocation efficiency, A. Z. Xiong. and G. X. Meng. reveal some important characteristics of the current technological innovation activities of Chinese pharmaceutical enterprises[14]. Through research, S. J. Wu. and H. M. Wu. found that government subsidies have a certain impact on LED enterprise scale economy efficiency and pure technical efficiency[15]. K. S. Lee et al. used DEA model to analyze the efficiency of high-growth IT firms[16]. K. K. Seo used DEA model to measure and analyze the efficiency of Korean listed display firms, and the results showed that six companies had the scalability efficiency[17]. J. w. Lee et al. used DEA-Malmquist to analyze the operational efficiency of forwarding companies registered in major overseas construction EPC companies. They believed that TCI of technological development showed a fluctuation, while TECI showed a relatively stable variation[18].

By analyzing the research results of scholars, we found that most scholars studied the application of technical efficiency theory and research methods with a wide range of research topics. However, the research on the efficiency of IC industry lacks sufficient literature support. The only studies on the efficiency of the industry have no revenue constraints on the selected DMU and are all from the perspective of input. Based on the theory of technical efficiency, this study focuses for the first time on companies with operating revenue less than 1 billion yuan and studies their efficiency from the perspective of output.

## 3. Research Method

This paper mainly adopts DEA analysis method in empirical analysis. Through the study of relevant literatures, it can be found that a large number of studies on efficiency evaluation conducted by domestic and foreign scholars also adopt DEA analysis method. As a non-parametric method, DEA model is one of the most common methods to evaluate efficiency. Since this method does not need to determine the specific production function, plus it can evaluate the efficiency of multiple inputs and outputs, and there is no clear limit on the requirements and number of input-output indicators, it is favored by many scholars, who apply DEA method to the efficiency evaluation of various industries. DEA evaluation efficiency as a non-parametric method, compared with general method basically has the following advantages: first, the DEA method is using to measure efficiency, in the form of a linear programming can be measured with multiple input and multiple output efficiency of decision making units, and the number of input and output index had no obvious requirement, also need not to no quantitative indicators principles; Secondly, when using DEA method to evaluate the efficiency of DMU, it is not necessary to know the specific production function form, and it is relatively simple and easy to conduct analysis with it, and less constrained by relevant variables. Thirdly, DEA can be used to measure TE, PTE and SE and other efficiency values of the evaluated object.

## 4. Research Results

The companies selected by the research institute are all companies with less than 1 billion revenue in 2018. The data are from the annual reports of A-share listed companies. As shown in Table 1, the units are all RMB 10,000. First, choose the evaluation index from the financial Angle. Based on previous research and relevant experience of scholars, input indicators can be divided into three categories: human input, material input and financial input. Therefore, the total amount of cash and fixed

**Table 1. Data sheet of 17 IC companies**

| DMU | R&D Expenditure | Cash paid to and for employees | Total fixed assets | Net profit | Sales revenue |
|---|---|---|---|---|---|
| Shanghai Belling | 8,815.83 | 10,200.00 | 5,702.59 | 10,300.00 | 71,800.000 |
| SinoWealth | 12,000.00 | 10,200.00 | 2,622.15 | 16,100.00 | 82,200.000 |
| NAVTECH | 5,430.05 | 17,900.00 | 21,600.00 | 9,976.26 | 63,600.000 |
| KFMI | 4,657.52 | 8,014.62 | 36,200.00 | 5,825.18 | 64,600.000 |
| SG MICRO CORP | 9,265.86 | 9,012.38 | 1,636.46 | 10,400.00 | 62,600.000 |
| WLCSP | 12,200.00 | 13,900.00 | 86,700.00 | 7,112.48 | 63,200.000 |
| Maxscend | 6,770.45 | 5,236.66 | 3,022.46 | 16,000.00 | 57,600.000 |
| ShanghaiSinyang | 5,082.65 | 7,729.78 | 20,000.00 | 613.84 | 63,800.000 |
| Beken Corporation | 7,768.13 | 5,461.48 | 5,284.39 | 12,400.00 | 58,100.000 |
| FINEMADE | 4,498.85 | 7,921.12 | 20,600.00 | 5,328.42 | 54,000.000 |
| JSZY | 4,723.61 | 12,000.00 | 124,600.00 | 3,093.69 | 49,100.000 |
| FHM | 11,900.00 | 9,022.73 | 18,700.00 | 4,626.44 | 45,900.000 |
| DanbondTechnology | 2,124.17 | 6,373.23 | 146,100.000 | 2,541.52 | 27,700.000 |
| Ingenic | 7,396.44 | 5,685.25 | 3,629.85 | 1,351.54 | 27,900.000 |
| ANJI TECHNOLOGY | 5,363.05 | 4,531.20 | 4,932.85 | 4,496.24 | 23,900.000 |
| NATAOPTO-ELECT | 3,735.73 | 5,404.49 | 22,400.00 | 5,547.82 | 18,400.000 |
| CCTECH | 6,170.99 | 7,525.41 | 13,400.00 | 3,647.11 | 15,500.000 |

**Table 2. Descriptive statistics of input & output indicators**

| Indicators | Total number of observed samples | min | max | mean | std. |
|---|---|---|---|---|---|
| R&D Expenditure | 17 | 2124.17 | 12200.00 | 6935.49 | 3021.51 |
| Cash paid to and for employees | 17 | 4531.20 | 17900.00 | 8595.20 | 3497.38 |
| Total fixed assets | 17 | 1636.46 | 146100.00 | 31595.93 | 44134.12 |
| Net profit | 17 | 613.84 | 16100.00 | 7021.21 | 4753.53 |
| Sales revenue | 17 | 15500.00 | 82200.00 | 49994.12 | 20072.29 |

assets paid to employees is included in the input index. The output of an enterprise is generally the product or service produced, and finally flows into the enterprise in the form of income. Therefore, enterprise income is selected as the output index, and net profit and sales income are selected as the output index in this paper. Sales revenue refers to cash received by the enterprise from selling goods and providing services. Secondly, compared with the traditional industry, the IC industry has the characteristics of high technology content. Enterprises' investment in innovation ability can be shown by capital investment, so research and development cost is selected as one of the investment indicators. As can be seen from Table 2, the 17 IC companies selected in this paper have great differences in five input and output indicators. The range of the maximum and minimum of each index is significant. At the same time, a significant difference was observed in the standard deviation of each term. Therefore, the descriptive statistical results of this sample data show that there is a large gap in input and output indicators between companies, and there is a significant difference in strength between companies. DEA model requires that the selection of evaluation index must meet the application conditions of the model, and at the same time, it can objectively reflect the basic characteristics of the industry of the research object. Secondly, it is technically necessary to avoid a strong linear relationship between input indicators and output indicators. Finally, the importance and availability of indicators should be considered. Therefore, we first performed a correlation test. This test mainly examines the correlation between each input index and each output index. The results are shown in Table 3 and Table 4. At the 1% level, there is no strong correlation between the three input and two output indicators, indicating that the input-output indicators selected in this paper conform to the principle of avoiding multicollinearity, which is reasonable and can be further studied.

**Table 3. Correlation of input indicators**

| Input indicators | R&D Expenditure | Cash paid to and for employees | Total fixed assets |
|---|---|---|---|
| R&D Expenditure | 1 | 0.242 | -0.323 |
| Cash paid to and for employees | 0.242 | 1 | 0.282 |
| Total fixed assets | -0.323 | 0.282 | 1 |

**Table 4. Correlation of output indicators**

| output indicators | Net profit | Sales revenue |
|---|---|---|
| Net profit | 1 | 0.546679 |
| Sales revenue | 0.546679 | 1 |

As the original data extracted from the company's annual report and related databases have different dimensions, the values of different indicators vary greatly. Moreover, DEA model requires non-negative data of input and output indicators, while some enterprises may have negative indicators such as net profit. For the above reasons, before using DEA model for efficiency analysis, all the original data were normalized. After processing, the overall shape of

the front surface formed by the decision making unit can be kept unchanged and only translation and scaling can occur, that is, the relative relation between decision making units can be guaranteed to remain unchanged and the final evaluation result will not be affected.

Normalization treatment formula: Let's say X = (x1, x2,⋯, xn) is the original data group with the same basic measurement unit, $X_{norm}$= ($X_{norm}$1, $X_{norm}$2 , ⋯⋯, $X_{norm}$n) is the normalized data group. Let's say $X_{\max}$= max (x1, x2 , ⋯ , xn), $X_{\min}$ = min(x1, x2 , ⋯ , xn) , $n \geq 3$,then $X_{norm}$= $\frac{X - X_{\min}}{X_{\max} - X_{\min}}$ $X_{norm} \in [0,1]$ , the normalized data were used for efficiency measurement, CCR and BCC models from the output perspective were used, and DEA-Solver was used in the analysis software. The results were shown in Table 5.

**Table 5. Efficiency Value**

| DMU | TE | PTE | SE | RTS |
|---|---|---|---|---|
| Shanghai Belling | 0.5871965 | 0.9628858 | 0.60983 | DRS |
| SinoWealth | 0.4938702 | 1 | 0.49387 | DRS |
| NAVTECH | 0.844453 | 0.9570852 | 0.882317 | DRS |
| KFMI | 1 | 1 | 1 | CRS |
| SG MICRO CORP | 0.4870918 | 0.8275362 | 0.588605 | DRS |
| WLCSP | 0.3734904 | 0.7688564 | 0.485774 | DRS |
| Maxscend | 0.6133765 | 0.8268174 | 0.741852 | DRS |
| Shanghai Sinyang | 0.9050086 | 0.9722788 | 0.930812 | DRS |
| Beken Corporation | 0.5392397 | 0.8063155 | 0.66877 | DRS |
| FINEMADE | 0.8653952 | 0.8669282 | 0.998232 | IRS |
| JSZY | 0.7494276 | 0.7582026 | 0.988427 | DRS |
| FHM | 0.2780916 | 0.5600272 | 0.496568 | DRS |
| Danbond Technology | 0.9401837 | 1 | 0.940184 | IRS |
| Ingenic | 0.2719592 | 0.3920454 | 0.693693 | DRS |
| ANJI TECHNOLOGY | 0.3212982 | 0.3605307 | 0.891181 | DRS |
| NATAOPTO-ELECT | 0.3551114 | 0.3595609 | 0.987625 | IRS |
| CCTECH | 0.1810919 | 0.2271801 | 0.797129 | DRS |

## 4.1 TE Analysis

TE analysis according to TE value measured by DEA, TE value is between 0 and 1. The closer TE is to 1, the more effective DEA is. If the value of TE is 1, it indicates that the input-output of the enterprise has reached the optimal state, and the input-output is located at the production frontier. On the contrary, it indicates that the input-output ratio has not reached the optimal state and the production frontier, and the output benefit needs to be improved. TE reflects the overall efficiency and takes into account the influence of PTE and SE, that is, TE is equal to the product of PTE and SE. According to the research experience of previous scholars and DEA requirements on dmu, when TE of dmu is 1, it is determined that the DMU is efficient. TE is a comprehensive measurement and evaluation of decision-making unit's resource allocation ability, resource utilization efficiency and other capabilities. As shown in the table, among the 17 listed companies in IC industry, only the TE of KFMI is 1, which constitutes the technological frontier of this industry. The company can make full use of the input resources and reach the maximum output. No matter in terms of technology or scale, their resource utilization has reached the optimal level, indicating that their input-output ratio has reached the optimal state. KFMI is the domestic leading enterprise in the high purity sputtering target industry, with abundant patents in hand, strong r&d strength, and strong downstream demand for its products and broad market space. TE values of other companies are all less than 1, so they are called DEA non-effective decision-making units. Effective and invalid states are relative, that is, compared with the DMU with TE value of 1, the utilization of input resources of the non-effective DMU is not optimal.

## 4.2 PTE and SE Analysis

PTE reflects the influence of input factors on TE in the case that factors such as production

technology, management level and system innovation are taken into consideration and scale remuneration is not considered. Scale effectiveness means that the input factors and output factors of an enterprise reach the optimal ratio. Some of the reasons for the invalidity of DEA are caused by the invalidity of PTE, some are caused by the invalidity of SE, and some are caused by both sides. Among them, the low efficiency of 2 companies is caused by SE deficiency. The PTE of SinoWealth and Danbond Technology is 1, but SE is less than 1.It shows that the performance management methods of these two companies are scientific and reasonable, but their production scale does not reach the optimal production scale. Combined with scale compensation, Danbond Technology should consider scale expansion and SinoWealth should consider scale reduction.

According to the measurement results, it can be found that the low efficiency of 14 companies is caused by the ineffectiveness of PTE and SE. In comparison, as shown in Fig. 1, all 6 companies show that PTE is smaller than SE, indicating that the company's production technology, development mode and regulations need to be improved. In order not to affect the TE of the company, these companies can improve the waste of existing resources. Rather than changing scale, they should first consider improving management. The remaining 8 companies should consider adjusting the ratio of input factors and output factors. Combined with the previous analysis, it can also be seen from Fig. 2 that, when the decline of TE in these 8 companies is relatively large, the sample companies are relatively serious in SE deficiency. On the whole, the deficiency of TE in the sample company can be divided into deficiency of PTE and deficiency of SE. Therefore, according to the results of efficiency measurement, improper production scale of the company is the most important problem, while improper application of current production technology is the secondary problem.

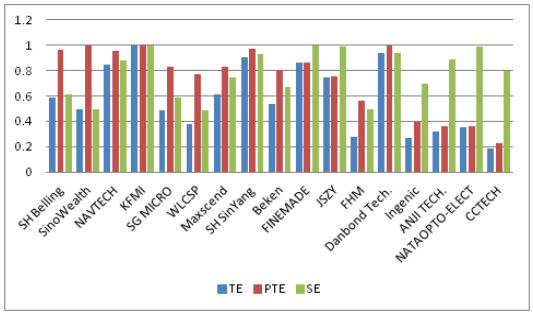


Fig. 1. 17 companies efficiency value comparison

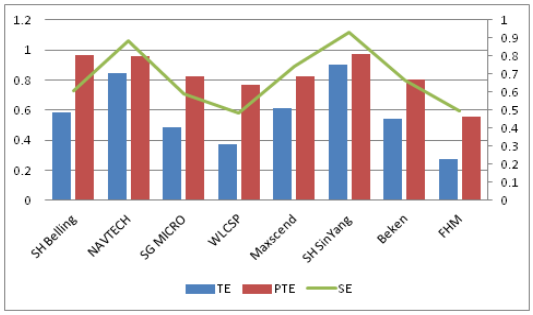


Fig. 2. The efficiency value of 8 companies with PTE greater than SE

KFMI SE is 1, the evaluation unit RTS remains unchanged, and the scale state is the best. For the evaluation unit where SE is not in the best state, companies in the increasing stage of RTS have small production scale and should continue to expand production scale, which also indicates that these companies are realizing scale effect and the revenue growth rate is higher than the scale growth rate under the current technical conditions. It is suggested that enterprises obtain scale remuneration by increasing innovation input and expanding production scale. DMU is in the stage of diminishing returns to scale, which means the output added value is less than the input. It is suggested that enterprises reduce resource input appropriately and strengthen scientific and technological innovation management to maximize the efficiency of resource utilization.

## 5. Conclusions and Implications

This paper adopts DEA analysis method to calculate the relative efficiency of 17 listed companies in China's IC industry with operating revenue less than 1 billion in 2018, and finds that one of the 17 companies is efficient, that is, it becomes the technological frontier of this industry. Among the 16 companies with inefficiency, 2 companies' inefficiency is completely caused by inappropriate scale. Among them, 1 company should consider expanding scale and 1 company should consider reducing scale. The inefficiencies of the other 14 companies are caused by the inadequacies of scale and the inadequacies of management level. It is advisable to improve the system and management level, and adjust the ratio of input and output factors accordingly. According to the above research results, we find that the PTE of some companies is far less than SE, which indicates that the company has a prominent influence on production efficiency due to management, technology and other factors. The level of operation management and R&D capacity of enterprises is generally low. This is mainly due to the lack of technological innovation capability and the lack of motivation for technological innovation. Based on this, the company should first continue to invest in technology development and innovation. If the company fails to keep up with the development trend of manufacturing technology at home and abroad, fully pay attention to the diversified and individual needs of customers, or the investment in follow-up research and development is insufficient, it will face the risk of reducing market competitiveness due to its inability to maintain continuous innovation ability. Second, unimpeded enterprise financing channels. Innovation capital input should not rely solely on the government, but should rely on the effective capital supply from the external capital market, including preferential policies in the securities market, banking industry, tax relief and fiscal subsidies provided by the government. Third, strengthen the training of technical personnel. In addition to recruiting foreign talents with high salary, we should strengthen the training of local college students majoring in related majors and in-service personnel to train local talents.

Of course, the study has many shortcomings. This paper only studies the data of some listed companies in IC industry for one year, and does not study the total factor productivity of the company. Moreover, the selected company has a small business scale and limited market share, so the comprehensive research on this industry is limited. Therefore, the follow-up study hopes to collate more complete data to better ensure objectivity and enrich the research content.

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곽 천 교(Tian-Jiao Guo) [정회원]

· 2001년 7월 : 길림사범대학 컴퓨터학과(이학사)
· 2009년 12월 : 길림대학 컴퓨터학과(공학석사)
· 2018년 3월 ~ 현재 : 세한대학교 경영대학원(박사과정)
· 2001년 8월 ~ 현재 : 길림공정기술사범학원 정보공학부 교수
· 관심분야 : 소프트웨어 공학, CAT
· E-Mail : 51466823@qq.com

양 준 원(Jun-Won Yang) [정회원]

· 1989년 2월 : 영남대학교 전자공학과(공학사)
· 1995년 4월 : 일본게이오대학 이공학연구과(공학석사)
· 1998년 4월 : 일본게이오대학 이공학연구과(공학박사수료)
· 1999년 3월 ~ 현재 : 세한대학교 항공교통물류학과 교수
· 관심분야 : 전자파해석, 위성통신, 스마트물류
· E-Mail : jwyang@sehan.ac.kr

김 형 호(Hyung-Ho Kim) [정회원]

· 1989년 2월 : 경희대학교 전자계산공학과(공학사)
· 1992년 8월 : 경희대학교 전자계산공학과(공학석사)
· 2018년 2월 : 인천대학교 동북아물류대학원(물류학박사)
· 1998년 3월 ~ 현재 : 세한대학교 항공교통물류학과 교수
· 관심분야 : 신경회로망, 항공운송, System Dynamics
· E-Mail : hhkim@sehan.ac.kr