Journal of Digital Convergence
Vol. 18. No. 1, pp. 73-81, 2020

ISSN 2713-6434 / eISSN 2713-6442
https://doi.org/10.14400/JDC.2020.18.1.073

# An Efficiency Analysis of Integrated Online and Offline Operations of Listed Retail Companies
## -Focusing on 28 listed retail companies in China-

Li-Yan Wu[1], Gui-Jung Kim[2], Hyung-Ho Kim[3*]
[1]Professor, Faculty of Machinary, Jilin Engineering Normal University
[2]Professor, Faculty of ICT, BaekSeok University
[3]Professor, Dept. of Air Transport and Logistics, Sehan University

# 상장 소매업체의 온라인·오프라인 통합 운영 효율성 분석
## -중국 28개 상장 소매업체를 중심으로-

무립염[1], 김귀정[2], 김형호[3*]
[1]길림공정기술사범학원 기계공학부 교수,
[2]백석대학교 ICT학부 교수, [3]세한대학교 항공교통물류학과 교수

**Abstract** The purpose of this paper is to analyze the efficiency of on-off-line integrated operations of listed retailers, propose ways to identify and improve the problems of inefficient enterprises, and accelerate the integration of on-off-line. The 28 listed retail companies selected total capital, management expenses, number of employees and wage rates as input factors as of 2018 and total operating income and operating profit were selected as output indicators to analyze efficiency using DEA. The results show that the integrated enterprise has a higher overall level of operational efficiency, but it is still in a state of stagnation. The pure technical efficiency of the integrated enterprise is generally higher, and the scale efficiency is the main reason that the overall efficiency of the enterprise is not improved. This study can help retail companies adjust their development strategies of online and offline integration according to their own degree of online and offline integration. This study has limitations in explaining the change in efficiency of retailers by conducting a cross-sectional analysis using data limited to 2018. It is necessary to utilize data over the next several years to conduct a longitudinal analysis.

**Key Words :** Retail Industry, DEA, Online and Offline Integration, Technical Efficiency, Scale Efficiency

**요 약** 본 논문의 목적은 상장 소매업체의 온·오프라인 통합운영 효율성을 분석하여 비효율적인 기업의 문제점을 파악하고 개선하기 위한 방안을 제안하는 것이다. 중국의 28개 상장 소매업체의 2018년 기준 자본금, 관리비, 직원수 및 임금률을 투입 지표로 하고, 총영업이익과 영업이익을 산출지표로 선정하여 DEA 분석 방법을 통해 운영효율성을 분석하였다. 분석 결과 온·오프라인 통합운영 소매업체의 운영효율성은 전반적으로 높은 편이지만 정체 상태이며, 온·오프라인 통합운영 소매업체의 순수기술효율성은 일반적으로 높고 규모효율성은 회사의 효율성이 향상되지 않는 주된 요인인 것으로 나타났다. 본 연구는 소매업체들의 온·오프라인 통합정도에 따른 운영효율성 향상을 위해 온·오프라인 통합 전략을 추진하는데 도움을 줄 것으로 기대한다. 본 연구는 2018년으로 한정된 데이터를 사용하여 횡적분석을 실시하여 소매업체의 효율성 변화 추이를 설명하기에는 한계가 있다. 향후 다년간의 데이터를 활용하여 종단면적 분석을 시행할 필요가 있다.

**주제어 :** 소매산업, 자료포락분석, 온·오프라인 통합, 기술적 효율성, 규모효율성

*This Paper was supported by the Sehan University Research Fund in 2020.
*Corresponding Author : Hyung-Ho Kim(hhkim@sehan.ac.kr)
Received November 5, 2019 Revised December 9, 2019
Accepted January 20, 2020 Published January 28, 2020

## 1. Introduction

With the continuous progress of network technology and the rapid development of e-commerce, market competition has entered a white-hot situation. The rising cost of physical retail leads to the closure of physical retail stores, and the gradual disappearance of the traffic dividend of online retail also makes online e-commerce enterprises face the dilemma of serious traffic failure. At the same time, the traditional offline supply chain system is also faced with the need to turn to a more efficient direction with the help of Internet technology. Under such circumstances, online retail and offline entities began to transform from confrontation to integration, and the integration of online and offline gradually became the main direction of retail industry reform in the new era of retail.

The online and offline integration of the retail industry refers to the mutual combination and infiltration of the online and physical retail industry to form a new retail way. Since the emergence of online and offline integration, although some enterprises implementing integration have achieved great results, most of them are still in the initial stage of exploration. Many experts and scholars in the field of economics in China have studied this kind of online and offline retail mode, and some scholars have pointed out that online sales and offline retail can achieve collaborative development, and they can complement and develop together while being independent[1]. Some scholars used empirical models to analyze the data of Chinese retail enterprises and found that the physical retail industry was more conducive to the increase of sales after the expansion of online sales[2]. Although many experts have conducted a lot of research on this issue, the impact of online and offline integration on retail efficiency has not been discussed. Therefore, this paper intends to use data envelopment analysis (DEA) method to analyze the operating efficiency of listed companies in China that implement online and offline integration, find out the problems existing in the implementation of online and offline integration, and put for ward targeted countermeasures and Suggestions to accelerate the development process of online and offline integration of retail industry.

## 2. Previous Researches

Foreign studies on retail efficiency mainly include: Bhat analyzed the relationship between insider holding and retail efficiency by the DEA method[3]. Ayupp & Kong analyzed the relationship between employee quality and retail efficiency[4]. Freeman et al. It discusses the innovation and productivity of the retail giant wal-mart, and points out that advanced retail technologies such as bar code technology and RFID have improved the efficiency of retail[5]. Kato analyzed the relationship between retail efficiency and economies of scale and product differentiation[6]. Sawant highlights the importance of foreign direct investment (FDI) in the development of India's retail industry[7].

Kumar & Chopra's empirical analysis shows that the level of customer satisfaction indirectly restricts the efficiency of the retail industry. Domestic studies on the efficiency of retail industry mainly focus on the empirical study on the total factor productivity of listed retail companies[8]. The DEA analysis method is used for efficiency analysis in various areas, including business operations and logistics of transportation companies, IT firms and securities firms[9-12]. In addition, there is also a study that empirically analyzed the growth rate of listed retailers in China by applying the DEA model and the Malmquist productivity index.[13-16]. X. F. Fan &M. X. Wang selected 22 listed retail companies and analyzed their efficiency changes and

micro-influencing factors with DEA and Tobit methods[16]. L. Lei used stochastic frontier model to empirically study the technical efficiency and macro influencing factors of retail industry in 30 provinces[18]. Based on the existing research at home and abroad and combined with the research on retail efficiency, this paper selects the input-output data of 28 listed retail companies that have established online channels to measure and compare the efficiency of online and offline retail enterprises in detail.

## 3. Research methods

In this paper, Data Envelopment Analysis (DEA) method and mathematical model are used to compare the efficiency of each DMU. DEA analysis method has the advantages of a wider calculation range, simpler calculation method, and less workload. DEA model is divided into CCR model and BCC model. The technical efficiency calculated according to the CCR model will be affected by the scale efficiency, so the calculation result is also called comprehensive technical efficiency. On the basis of CCR model, the technical efficiency calculated by BCC model will not be affected by scale efficiency, and the calculated result becomes pure technical efficiency. The ratio of comprehensive technical efficiency to pure technical efficiency reflects the impact of scale on unit technical efficiency, so it is called scale efficiency. The change of technical efficiency from t period to t+1 period is called technical efficiency change, which is divided into pure technical efficiency change (PEC) and scale efficiency change (SEC). The quantitative relationship is as follows:

tfpch = effch * techch

effch = pech *sech

In terms of analyzing the operating efficiency at the enterprise level, the DEA method is a basic and common method, which is widely used in the study of the operating efficiency of retail enterprises in many countries

## 4. Empirical analysis

Listed retail companies represent large retail enterprises with a certain strength in China's retail industry. They are a miniature of benchmark enterprises in the industry and national retail enterprises. To some extent, they reflect the development of China's retail industry and have strong representativeness. In addition, the listed company should disclose the annual report reflecting the operating conditions every year, which makes the data sources have relative reliability and objectivity when doing research.

### 4.1 description of data and variable

Considering that the operation of newly listed companies is not stable, this paper chooses Shanghai and Shenzhen a-share companies that have been listed for at least five years. From 81 a-share listed retail companies, 28 retail enterprises that have implemented online and offline integration were selected as sample enterprises through searching and screening online one by one. The sample is 2018 data, and the data are mainly from Guotaian database and listed company data published by Shanghai and Shenzhen stock exchanges. Before DEA is used to measure the efficiency of listed companies in the retail industry, input and output indicators should be clarified. In line with the requirements of data availability, representativeness and no collinearity among indicators[19], and with reference to previous research results (see Table 1). This paper selects 4 input indicators and 2 output indicators (see Table 2).

Investment is mainly measured from the aspects of capital input and labor input. The total amount of assets is selected to measure the

**Table 1. Literature adopting DEA method**

| author | object | method | Input | output |
|---|---|---|---|---|
| Thomas et al. | A 552 store in the United States | DEA | Headcount, employee manager's experience, operating expenses, inventory | Sales, profit |
| Donthu and Yoo | A food retailer with 24 stores in the UK | DEA | Business area, number of years of service of the manager | Sales, customer satisfaction |
| X.Y.Wang | 10 department stores in a city of China | DEA | Number of employees, business area, sales expenses, circulation amount | Gross sales profit, total sales |
| Ratchford | American food retail store | DEA MPI | Labor, capital | Stock width, service quality index |
| Barros | 22 supermarkets in Portugal | DEA Tobit | Number of employees, total assets | sales |
| B.Yang | China retail listed company | DEA MPI | Employee compensation, net fixed assets, operating expenses, administrative expenses | Main business income, net profit |
| X.D.Liu, Z.W.Li, CH. CH.Zhang | Entity retail enterprise | DEA | Store area, number of employees, operating expenses, utilities expenses | Retail gross margin |

**Table 2. input and output indexes of DEA model**

| Indicator species | Index name | unit |
|---|---|---|
| Input indicators | Total assets | yuan |
| | Management fees | yuan |
| | Number of employees | person |
| | Employee wages | yuan |
| Output indicators | Gross operating income | yuan |
| | Operating profit | yuan |

scale of the enterprise, and the management expense is selected to measure the expenses in the operation process of the enterprise. The number of employees and the salary of employees is selected to reflect labor quantity and labor cost respectively. The output is mainly reflected by the operating effectiveness of the enterprise, and the total operating income and operating profit are selected. The total operating income reflects the overall operating situation of the enterprise. Operating profit is the target of enterprise management, which is related to operating efficiency and resource allocation efficiency.

## 4.2 Analysis of empirical results

DEA Solver18 software was used to analyze the input-output data of 28 listed retail companies in 2018 from an individual perspective. The DEA model can be further divided into input-oriented and output-oriented. Input-oriented is reasonable planning to minimize input on the premise of a certain output level. Output-oriented is reasonable planning to maximize output on the premise of a certain input level. Since retail enterprises are commercial enterprises, and the sales volume is a comprehensive indicator reflecting the scale and status of their business activities, the investment scale of listed enterprises has been basically mature. In addition, this paper USES the output-oriented BCC model for reference, hoping to study how to improve the production efficiency of enterprises under the condition of keeping input unchanged.

### 4.2.1 DEA - CCR analysis

According to the technical efficiency in Table 3, the average technical efficiency of 28 enterprises in 2018 was 0.8373. Among them, 11 enterprises, including ZHONGBAI HOLDINGS GROUPCO.,LTD et al., reached 1, accounting for 39.29%, and nearly half of them reached the optimal operating efficiency. Thirteen enterprises, such as YONGHUI SUPERSTORES , whose technical efficiency has not reached above 0.9, have relatively low operating efficiency and are late to implement the integration method. Therefore, it is necessary to refer to the model enterprise for reference and experience to further implement the integration.

**Table 3. DEA values of 28 listed retail companies in 2018 CCR(O)**

| DMU | Score | Rank |
|---|---|---|
| SUNING.COM | 1 | 1 |
| YYTM | 1 | 1 |
| BCRG | 1 | 1 |
| BEIJING BASHI MEDIA CO.,LTD | 1 | 1 |
| HJBG | 1 | 1 |
| WUSHANG GROUP | 1 | 1 |
| Shenzhen Neptunus Bioengineering Co.Ltd | 1 | 1 |
| RAINBOW | 1 | 1 |
| ZHONGBAI HOLDINGS GROUPCO.,LTD | 1 | 1 |
| CBEST | 1 | 1 |
| BIEJINGHUALIAN HYPERMARKET CO.,LTD | 1 | 1 |
| XHCG | 0.9951 | 12 |
| Wangfujing | 0.9762 | 13 |
| n.n.store | 0.9654 | 14 |
| INZONEGROUP | 0.9300 | 15 |
| FJDB | 0.9115 | 16 |
| YONGHUI SUPERSTORES | 0.8992 | 17 |
| SNW | 0.8224 | 18 |
| SHENYANG COMMERCIAL CITY CO.,LTD | 0.7865 | 19 |
| CCEG | 0.7668 | 20 |
| FIYTA | 0.7505 | 21 |
| HEFEI DEPARTMENT STORE GUOUPCO.,LTD | 0.6553 | 22 |
| SBGCL | 0.6411 | 23 |
| ZYSC | 0.5858 | 24 |
| DFGC | 0.5537 | 25 |
| HSGC | 0.4478 | 26 |
| NJXB | 0.4250 | 27 |
| BEIJING URBAN-RURAL COMMERCIAL CO.,LTD | 0.3520 | 28 |

### 4.2.2 DEA-BCC analysis.

From the perspective of pure technical efficiency, as shown in Table 4, the average pure technical efficiency of 28 listed retail companies implementing integration in 2018 was 0.9096, and 19 enterprises reached the optimal technical efficiency, accounting for 67.86%. More than half of the enterprises implementing online and offline integration have achieved the optimal level of pure technical efficiency, which indicates that the enterprises implementing integration have made effective use of the resources invested by the company, and their overall management level and technical level are relatively good. Among the enterprises that did not reach the optimal pure technical efficiency, the pure technical efficiency of 6 enterprises, including HSGC, was below 0.8 level, indicating that the management level and utilization of resources needed to be improved.

**Table 4. DEA values of 28 listed retail companies in 2018 BCC(O)**

| DMU | Score | Rank |
|---|---|---|
| SUNING.COM | 1 | 1 |
| YYTM | 1 | 1 |
| BCRG | 1 | 1 |
| BEIJING BASHI MEDIA CO.,LTD | 1 | 1 |
| HJBG | 1 | 1 |
| FIYTA | 1 | 1 |
| YONGHUI SUPERSTORES | 1 | 1 |
| WUSHANG GROUP | 1 | 1 |
| Shenzhen Neptunus Bioengineering Co.Ltd | 1 | 1 |
| RAINBOW | 1 | 1 |
| SHENYANG COMMERCIAL CITY CO.,LTD | 1 | 1 |
| ZHONGBAI HOLDINGS GROUPCO.,LTD | 1 | 1 |
| CBEST | 1 | 1 |
| n.n.store | 1 | 1 |
| XHCG | 1 | 1 |
| CCEG | 1 | 1 |
| BIEJINGHUALIAN HYPERMARKET CO.,LTD | 1 | 1 |
| FJDB | 1 | 1 |
| DFGC | 1 | 1 |
| Wangfujing | 0.9997 | 20 |
| INZONEGROUP | 0.9751 | 21 |
| SNW | 0.9692 | 22 |
| HSGC | 0.7373 | 23 |
| SBGCL | 0.6793 | 24 |
| HEFEI DEPARTMENT STORE GUOUPCO.,LTD | 0.6579 | 25 |
| ZYSC | 0.5946 | 26 |
| BEIJING URBAN-RURAL COMMERCIAL CO.,LTD | 0.4283 | 27 |
| NJXB | 0.4279 | 28 |

### 4.2.3 Comparison of CCR-BCC analysis results

From the scale efficiency in Table 5, the overall average scale efficiency of 28 enterprises in 2018 is 0.9191. Among them, 12 enterprises have reached optimal scale efficiency, accounting

Table 5. DEA value of individual operating efficiency of 28 retail listed companies in 2018

| S/N | DMU | TE | PTE | SE | Scale return state |
|---|---|---|---|---|---|
| 1 | SUNING.COM | 1 | 1 | 1 | Constant |
| 2 | YYTM | 1 | 1 | 1 | Constant |
| 3 | BCRG | 1 | 1 | 1 | Constant |
| 4 | BEIJING BASHI MEDIA CO.,LTD | 1 | 1 | 1 | Constant |
| 5 | HJBG | 1 | 1 | 1 | Constant |
| 6 | WUSHANG GROUP | 1 | 1 | 1 | Constant |
| 7 | Shenzhen Neptunus Bioengineering Co,Ltd | 1 | 1 | 1 | Constant |
| 8 | RAINBOW | 1 | 1 | 1 | Constant |
| 9 | ZHONGBAI HOLDINGS GROUPCO.,LTD | 1 | 1 | 1 | Constant |
| 10 | CBEST | 1 | 1 | 1 | Constant |
| 11 | BIEJINGHUALIAN HYPERMARKET CO.,LTD | 1 | 1 | 1 | Constant |
| 12 | XHCG | 0.9951 | 1 | 0.9951 | Increasing |
| 13 | Wangfujing | 0.9762 | 0.9997 | 0.9765 | Constant |
| 14 | n.n.store | 0.9654 | 1 | 0.9654 | Increasing |
| 15 | INZONEGROUP | 0.9300 | 0.9751 | 0.9537 | Increasing |
| 16 | FJDB | 0.9115 | 1 | 0.9115 | Increasing |
| 17 | YONGHUI SUPERSTORES | 0.8992 | 1 | 0.8992 | Decreasing |
| 18 | SNW | 0.8224 | 0.9692 | 0.8485 | Increasing |
| 19 | SHENYANG COMMERCIAL CITY CO.,LTD | 0.7865 | 1 | 0.7865 | Increasing |
| 20 | CCEG | 0.7668 | 1 | 0.7668 | Decreasing |
| 21 | FIYTA | 0.7505 | 1 | 0.7505 | Increasing |
| 22 | HEFEI DEPARTMENT STORE GUOUPCO.,LTD | 0.6553 | 0.6579 | 0.9960 | Constant |
| 23 | SBGCL | 0.6411 | 0.6793 | 0.9438 | Constant |
| 24 | ZYSC | 0.5858 | 0.5946 | 0.9852 | Increasing |
| 25 | DFGC | 0.5337 | 1 | 0.5337 | Decreasing |
| 26 | HSGC | 0.4478 | 0.7373 | 0.6074 | Increasing |
| 27 | NJXB | 0.4250 | 0.4279 | 0.9932 | Increasing |
| 28 | BEIJING URBAN-RURAL COMMERCIAL CO.,LTD | 0.3520 | 0.4283 | 0.8219 | Increasing |
| Avg. | | 0.8373 | 0.9096 | 0.9191 | |

for 42.86%, which indicates that the scale of resource input of these 11 enterprises is relatively reasonable. At its best. Among the 16 enterprises whose resource input did not reach the best, 11 enterprises, including XHCG, showed an increasing scale return. They should appropriately increase capital and employee input, appropriately expand enterprise scale, and give full play to their own advantages. Three enterprises, such as YONGHUI SUPERSTORES, in a state of diminishing return on scale, show that the resource input of these companies has not been effectively utilized. These enterprises can appropriately reduce the enterprise scale and reduce the investment of capital and manpower. Table 5 shows that the pure technical efficiency of YONGHUI SUPERSTORES, CCEG and DFGC is 1, which has reached a relatively optimal state. However, technical efficiency and scale efficiency have not reached the optimal level. Especially, the pure technical efficiency of DFGC is 1, while the technical efficiency is only 0.5337, and the return on scale is decreasing. It shows that these enterprises have a good level of technology and management, and fully integrate big data and artificial intelligence into the online and offline integration of the retail industry. However, the scale of resource investment is not optimal, and it needs to be reduced appropriately. The pure technical efficiency of the six enterprises

including XHCG is 1, but the technical efficiency is less than 1, and the return to scale is increasing. It shows that the resource management level and technical level of these six companies are good, but the scale of resource input is not ideal, so the resource input can be appropriately increased to improve the technical efficiency.

## 5. Conclusion

This paper makes an in-depth analysis of the online and offline integration behaviors of retail companies, which is helpful for retail companies to adjust their development strategies of online and offline integration according to their own degree of online and offline integration. In order to improve the operation efficiency of listed companies in the retail industry, some countermeasures are put forward to accelerate the integration process between online and offline.

Through the analysis of this paper, it can be found that the efficiency of many online and offline retailers has not been significantly improved, which indicates that China's retail industry still has great room for improvement. To improve the operating efficiency of listed retail companies, the following points should be achieved:

First, We will actively implement online and offline integration. According to the input-output index analysis results of 28 listed retail companies implementing online and offline integration in 2018, The overall operating efficiency of enterprises implementing online and offline integration is relatively high. Most of them are above 0.9 level, and nearly half of them reach the optimal technical efficiency. It shows that the implementation of online and offline integration is of great significance to the rapid development of the retail industry. Therefore, the integration of online and offline should be actively advocated to complement the convenience and expansibility of online with the professionalism and low threshold of offline, so as to improve the overall operating efficiency of the retail industry. Second, Learn from the success of existing companies. Although the overall operating efficiency of the integrated enterprise is relatively high, the analysis results show that the overall efficiency has little change. It shows that the integration of the retail industry is currently in a bottleneck stage, which needs the support of relevant theories. It requires the integration enterprises to find the problems in the integration, summarize the integration experience of the successful enterprises and seek breakthroughs. Third, Adjust the scale of enterprise operation according to the actual situation of the enterprise. According to the decomposition results of technical efficiency, the technical efficiency of enterprises over 1/2 reached the optimal level, but the scale efficiency was relatively low. It shows that the main reason for the slow technical efficiency of integrated enterprises is the unreasonable scale of enterprise resource investment. Therefore, enterprises currently implementing online and offline integration should adjust their scale appropriately according to their scale compensation status, integrate existing resources, give full play to their advantages and improve utilization efficiency. Fourth, Establish and improve the logistics distribution system. In the new retail model, the key to integration is the combination of online and offline logistics. As can be seen from the output results, integration has entered a bottleneck stage. The main reason is that most enterprises have not truly integrated online and offline logistics. Therefore, in order to improve integration efficiency, efforts should be made to improve the management level of the logistics supply chain. Through the application of big data and artificial intelligence, an intelligent logistics system should be established to realize the synchronous sharing of online and offline information and seamless connection of

channels, so as to improve the comprehensive service capability. This study has limitations in explaining the change in efficiency of retailers by conducting a cross-sectional analysis using data limited to 2018. It is necessary to utilize data over the next several years to conduct a longitudinal analysis.

## REFERENCES


[1] X. M. Guo & S. S. Shi. (2019). luation on Efficiency of China's Department Store Listed Companies after online and offline Integration Development. *Journal of Beijing Technology and Business University, 39(1),* 63-71. http://www.airitilibrary.com/Publication/alDetailedMesh?docid=bjgsdxxb-sh201901007

[2] Y. Y. Li. (2017). Study on the Impact of the Omni Channel Integration Level on Retailers' Operating Efficiency —Based on Chinese Listed Companies. *Zhongnan university of economics and law,* 24-59. http://cdmd.cnki.com.cn/Article/CDMD-10520-1017740753.htm

[3] V. N. Bhat. (2008). Productivity in the retail industry: does insider ownership of shares matter? *Applied Financial Economics Letters, 4(2),* 121-125. DOI : 10.1080/17446540701537731

[4] K. Ayupp & W. Kong. (2010). The impact of task and outcome inter dependence and self-efficacy on employees' work moti-vation: an analysis of the Malaysian retail industry. *Asia Pacific Business Review, 16(1),* 123-142. DOI : 10.1080/13602380701517048

[5] R. B. Freeman et al. (2011). Wal-Mart innovation and productivity: a viewpoint. *Canadian Journal of Economics: Revue canadienne décono-mique, 44(2),* 486-508. DOI : 10.1111/j.1540-5982.2011.01641.x

[6] A. Kato. (2012) . Productivity, returns to scale and product differentiation in the retail trade industry: an empirical analysis using Japanese firm-level data. *Journal of Productivity Analysis, 38(3),* 345-353. https://link.springer.com/article/10.1007/s11123-011-0251-1

[7] S. V. Sawant. (2012) . Foreign direct investment and retailing in India-issues and challenges ahead. *Journal of Com-merce and Management Thought , 3(4),* 692-706. http://www.indianjournals.com/ijor.aspx?target=ijor:jcmt&volume=3&issue=4&article=010

[8] S. N. V. S. Kumar & A. Chopra. (2013). Determinants of customer satisfaction of traditional and modern formats in food and grocery: the case of Indian retail. *International Journal of Research in Commerce , Economics & Management, 3(2),* 44-51. http://www.cabdirect.org/cabdirect/abstract/2013332714

[9] Y. J. Kim, T. S. Kim, G. S. Jung, J. J. Hwang, H. S. Lee & S. A. Kim. (2013). Efficiency Analysis of the Securities Firms using a Combined BSC and DEA Model. *Journal of Digital Convergence, 11(5),* 159-168. http://www.earticle.net/Article/A199719

[10] J. W. Lee, S. H. Park, J. G. Oh & G. T. Yeo. (2018). An Analysis of Forwarding Companies' Efficiency handling Overseas Construction Project Logistics using DEA. *Journal of Digital Convergence, 16(6),* 75-84. DOI : 10.14400/JDC.2018.16.6.075

[11] K. I. Lee & D. Y. Kang. (2019). A Study on the Management Efficiency Analysis of IT high-growth Corporation : Using DEA. *Journal of Digital Convergence, 17(7),* 27-34. DOI : /10.14400/JDC.2019.17.7.027

[12] S. G. Yoon, S. H. Park, H. M. Ma & G. T. Yeo. (2017). A Study on the Operating Efficiency of Parcel Delivery Sub-terminal Agency focus on A company. *Journal of Digital Convergence, 15(10),* 31-43. DOI : 10.14400/JDC.2017.15.10.31

[13] H. Fang, Z. H. Feng & B. Peng. (2009). Research on the China's Retail Enterprise Technical Progress and Technical Efficiency. *Chinese Retail Research Journal, 2(6),* 57-66. http://www.cnki.com.cn/Article/CJFDTotal-CLSY200901008.htm

[14] X. H. Wang & C. Y. Wan. (2009). Productivity Growth, Technical Progress and Efficiency Change in Chinese Retail Listed Companies-- A Study based on Malmquist Index. *Economic Management Journal, 31(5),* 43-47. http://www.cnki.com.cn/Article/CJFDTotal-JJGU200905013.htm

[15] B. Yang. (2012). Operation Efficiency Evaluation and Analysis of Chinese Retail Listed Companies. *Journal of Shanxi Finance and Economics University, 34(1),* 52-61. http://www.cqvip.com/qk/96461a/201201/40553700.html

[16] L. Lei. (2013). Empirical Study on TFP Growth in Chinese Retail Listed Companies Based on an Analysis of Malmquist Index. *Journal of Beijing Technology and Business University(Social Science), 32(6),* 20-26. http://www.cqvip.com/qk/96433a/201306/48345209.html

[17] X. F. Fan & M. X. Wang. (2001). eration Performance Evaluation and the Analysis of Micro-influencing Factors of the Domestic Retal Enterprises. *Journal of Northwest University(Philosophy and Social Sciences Edition), 42(5),* 36-31. http://www.cqvip.com/qk/80759x/201103/37940001.html

[18] L. Lei. (2014). Empirical Study on Technical Efficiency and Influencing Factors in China's Retail Industry. *Journal of Beijing Technology and Business University(Social Sciences, 34(6),* 28-36. http://www.cqvip.com/qk/96433a/201406/663280215.html

[19] H. Q. Zhang. (2017). Empirical analysis of operating

efficiency of listed companies in China's retail industry. *Journal of Commercial Economics, 36(14),* 157-159.
http://www.cqvip.com/qk/96790x/201714/7000252915.html

무 림 염(Li-Yan Wu) [정회원]

· 2000년 7월 : 창춘대학교 기계학과(공학학사)
· 2011년 7월 : 창춘이공대학교 기계학과(공학 석사)
· 2018년 5월 ~ 현재 : 세한대학교 경영대학원 박사과정
· 2000년 9월 ~ 현재 : 길림공정기술사범학원 기계공학부 교수
· 관심분야 : 마케팅, 기계, 산업디자인
· E-Mail : 108809373@qq.com

김 귀 정(Gui-Jung Kim) [정회원]

· 1994년 2월 : 한남대학교 전자계산공학과 (공학사)
· 1996년 2월 : 한남대학교 전자계산공학과 (공학석사)
· 2003년 2월 : 경희대학교 전자계산공학과(공학박사)
· 2017년 3월 ~ 현재 : 백석대학교 ICT학부 교수
· 관심분야 : CRM, 정보보호, 전자상거래
· E-Mail : gjkim@bu.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