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The Sustainable Development of Cross Border E-Commerce: A Study on China' Experience

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Rui Xue, HuiZheng Liu , Xin Xiong, Xue Li, Muhammad Afaq Haider[*†]

ABSTRACT

It is well known that China leads the world in e-commerce. More than 40% of the world's e-commerce transactions currently take place in China. However, due to the late start of cross-border e-commerce, it has restricted the sustainable development of cross-border e-commerce in terms of technology, finance, market and so on. Consequently, this paper employs the data envelopment analysis to establish a theoretical model to evaluate Chinese cross-border e-commerce's sustainable development ability. Using the data of China from 2008 to 2018, this paper evaluates the sustainable development ability of cross-border e-commerce in terms of logistics revenue, cross-border e-commerce penetration rate, online shopping user size as inputs, cross-border e-commerce transaction size, import and export of goods as outputs. According to the analysis result, the advice and guidelines to developing nations for setting policies and programs to develop cross-border e-commerce are also provided.

INTRODUCTION

In the past decades, the development of cross-border e-commerce (CBEC) in China has shown a rapid trend of overall scale growth, which has a profound impact on people's life [1]-[3]. It brings vitality to China's domestic market and opens up a new way of foreign trade, which has a far-reaching impact on China's trade development [4]-[6]. In the era of "Internet +", the demand of individual consumers and enterprises for CBEC is increasing [7], [8]. In 2017, statistics of the CBEC management platform of Customs showed that the total retail import and export of China reached 90.24 billion RMB, an increase of 80.6% [9]. Thanks to the CBEC, China has become an important exporter of products all over the world [10]. With the overall export volume relatively stable, the development of CBEC is gradually surpassing traditional trade [11], [12]. To support the development of CBEC, many important departments in China have promulgated corresponding policies to support the development of cross-border export e-commerce [13]. China's Ministry of Commerce promulgated Several Opinions on Developing Foreign Trade by Using E-commerce Platform and selected some cities as pilot projects of CBEC trade services to explore the management system and rules of CBEC development in 2012 [14]. The Customs added the code of CBEC supervision mode to further facilitate enterprise customs clearance and standardize customs management in 2014. In 2016, China issued the State Council's Approval for the Establishment of a Comprehensive Test Zone for Cross-border E-Commerce in 12 Cities, such as Tianjin to comprehensively replicate and promote the supervision and service system of CBEC information sharing, financial services, intelligent logistics, risk prevention, and control, to promote CBEC into the fast lane [15]. These policies go deep into all aspects of CBEC, ranging from the overall system and environmental construction to the pilot of comprehensive pilot zones for CBEC and the specific links of CBEC, such as taxation, payment, customs clearance, and overseas warehouses, to remove obstacles to the development of cross-border export e-commerce and create various favorable conditions to promote its rapid

* Research Base of Beijing Modern Manufacturing Development, College of Economics and Management Beijing University of Technology, Beijing/CHINA

development [5]. According to the forecast, the scale of CBEC transactions in China can still maintain a compound growth rate of 16% per year [16].

By 2020, the scale of CBEC transactions can reach 12 trillion RMB, accounting for more than 37% of the total import and export of goods [17]. It is estimated the annual composite growth rate from 2018 to 2022 will be about 30.72%, and 7.4 trillion RMB in 2022 [18].
In general, China's CBEC is at a stage of vigorous development, but there are still problems such as imperfect management system, imperfect laws and regulations and insufficient competitiveness, which restrict the development of CBEC [19]. However, the current research is mainly focused on CBEC competitiveness and development status. Few kinds of research about the potential and space of the sustainable development of CBEC. In fact, internal factors and external factors affect the development of CBEC, such as international logistics and CBEC network users [20]. Nowadays, the sustainable development capability of CBEC is critical for the development direction for the small and medium enterprises [17], [21]. Therefore, it became a key role in guiding future development from a strategic perspective. In other words, the prediction of CBEC development is important for making suitable policies. Hence, the objective of this paper is to evaluate the sustainable development ability of CBEC in China. This study not only adds to the literature by providing the model for assessing the CBEC sustainable development ability to the developing nations but also provides inputs to assist policymakers to create a mechanism design to enhance the CBEC development ability. Based on the Chinese CBEC data collected from 2008 to 2018, the analysis result can provide a decision-making basis and countermeasures for the relevant government decision-making departments.

The remainder of this paper is organized as follows. Section 2 reviews the current research on the CBEC sustainable development capability and data envelopment analysis (DEA) method application and DEA method application. Section 3 introduces the method to evaluate the CBEC sustainable development capability, including the DEA model and the selection of the indicators. In Section 4, the empirical result, including the comprehensive analyses of the efficiency value and redundancy will be presented. How to optimize the state of CBEC will also be provided in detail. Finally, conclusions are drawn in Section 5.

LITERATURE REVIEW

We first present the important definitions of this paper: cross-border electronic commerce and sustainable development in section 2.1. Then we introduce the related research from the CBEC evaluation indicators, the current development of CBEC and the study on the sustainable development of CBEC perspectives in section 2.2.

Relevant definitions

1) Cross-border Electronic Commerce

With the popularity of the Internet and the rapid development of China's economy, CBEC has gradually become the backbone of the e-commerce era [22]. From the definition of the e-commerce perspective, different scholars have different understandings of CBEC. The concept of CBEC has not been clearly defined, and researchers have put forward constructive views and generalizations in relevant studies. With regard to the early definition of the vague concept of electronic commerce, the United Nations Commission on International Trade Law defined electronic commerce as a commercial activity on the Internet, which is an alternative form of information exchange and storage on paper [23]. The main functions include advertising, customer service, order payment, delivery of goods and other services, as well as market analysis, financial audit, production arrangements and other business activities using the Internet. The United Nations Organization for Economic Co-operation and Development defines e-commerce as a business activity conducted by electronic means [24]. As the speed of CBEC continues to accelerate, people's understanding of CBEC continues to deepen.

According to The Research Report on China's CBEC Talents published on June 2, 2015, it defines CBEC as an international business activity that achieves transactions through e-commerce platforms, performs payment settlement, and delivers goods through cross-border logistics and completes transactions is divided into transaction entities of different customs [25].

Generally speaking, CBEC is basically equivalent to foreign trade e-commerce, which refers to the transaction subject belonging to different customs, through the means of e-commerce to electronically display, negotiate and trade links in traditional import and export trade, and cross-border. An international business activity in which goods are delivered to goods and transactions are completed. In a broader sense, CBEC refers to the application of e-commerce in import and export trade, which is the electronic, digital and network of traditional international trade business processes. It involves many aspects of activities, including electronic trading of goods, online data transfer, electronic funds transfer, electronic shipping documents and so on.

According to the common characteristics, [26] defines the CBEC as that the transaction entities belong to different customs, and the transaction links rely on the Internet, mobile terminals and other platforms for product display, negotiation, transaction, and payment settlement, and deliver goods through cross-border logistics. The classification of CBEC is divided according to the e-commerce transaction subject, import and export direction, and transaction method [4]. In real life, CBEC can be divided into three categories: individual level, enterprise level and government level CBEC according to different transaction entities; CBEC in China is divided into export CBEC and imported CBEC according to the import and export direction; Trading methods are divided into business-to-business (B2B) and business-to-consumer (B2C) trading models [27]. The products of CBEC include virtual and physical products or services. The way of sales settlement through the network platform mainly includes the transaction subject to reach the sales contract, cross-border electronic payment, customs declaration, cross-border logistics operation and so on. Based on the definition of CBEC above, we define the CBEC in this paper as a series of trade processes such as transaction, payment and settlement of e-commerce through the Internet [26].

2) Sustainable development

Recently, research on sustainable development capability is one of the most important research topics [28]. In 1987, the Brundtland Commission was the first to give the original definition of sustainable development [29]. As stated in the paper of Our Common Future, Sustainable development is the kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs [29]. Therefore, sustainable development involves many aspects such as nature, environment, society, economy, science and technology, and politics, people's definition of sustainable development is different based on different research perspectives. Since the Rio conference in 1992, this definition has constituted the basis for most of the generally accepted definitions of sustainable development. Sustainable development capability has been widely studied [30]. The FISD Sustainability Indicator System framework was established by the United Nations Statistics Office in 1994 [31]. The Sustainable Development Indicators System, published by the World Bank in 1995, considers sustainable development as a process of generating and sustaining the wealth it holds [31].

Sustainable development is the mainstay of today's era, and it is especially important to focus on sustainable economic development. In the process of development, we will balance the natural resources and service quality, enhance the core competitiveness of CBEC, and explore and adjust the industry model suitable for long-term development, in order to obtain a continuous development momentum of CBEC.

Research on sustainable development CBEC

With the development of the digital economy era and the globalization process, the traditional trade model is gradually changing. CBEC has gradually become the mainstream trade mode nowadays. The existing research mainly concentrates on the following three aspects, including CBEC indicators definition, selection, and analysis, the internal and external factors affecting the development of CBEC and the sustainable development of CBEC enterprises.

1) Analysis of CBEC indicators

In 2001, Jutla proposed six categories of e-business readiness indicators and measures to assess a country's performance in providing a positive e-readiness environment [32]. Kaisara and Pather put forward the primary index database for evaluating the successful development of e-commerce in 2006 [33]. By using the empirical analysis method, he studied the foreign trade business of a medium-sized enterprise in South Africa through the business platform for many years. The four dimensions of the virtual e-commerce market are communication, information, transaction, and marketing [33]. In 2019, Miao et al. analyzed the favorable factors for the growth of CBEC enterprises from the supply, demand,

policy and related industry supporting perspectives [34]. They analyzed the constraints on the growth of CBEC enterprises from the perspectives of talent, product homogeneity, product quality and after-sales service, international marketing and large data analysis ability.

2) Constraint affecting the development of CBEC

An OECD study found that the barriers affecting the development of CBEC include lack of awareness, uncertainty of e-commerce benefits, security concerns, lack of human resources and skills, setting costs and pricing issues [35]. Thatcher and Foster found that organizational, industrial, governmental and cultural factors do influence B2B e-commerce adoption decisions in Taiwan in 2005 [36]. Sinkovics et al. build on Hofstede's and Hall's cultural framework to evaluate whether adaptation of online/internet messages to local cultures is important [37]. They found that cultural value depiction is not very strong in the relevant markets, thus a certain degree of cultural alienation' takes place. In 2018, in view of the inferior position of CBEC in China due to multiple factors such as financing difficulties, technical shortcomings and imperfect system. In 2019, He et al. studied the logistics resource sharing problem between two Business-to-Consumer (B2C) E-commerce companies [38]. They found that the sharing always benefits the logistics receiver company, but benefits the logistics provider company only when both the degree of differentiation between companies and the logistics provider's logistics efficiency are relatively high.

3) Sustainable development of CEBC

Goyal studied the relationship between sustainable development performance and corporate performance in 2013, in which financial performance was used as a representative of corporate performance [39]. They argued that developing countries need to conduct further empirical research on the relationship between sustainable development performance and firm performance. In 2014, the study carried out by Sueyoshi and Goto employed the DEA radial method to test the sustainability of Japanese industrial sector enterprises [40]. Hsiao et al. proposed to use Kansei engineering with text-mining-based online content analysis to improve the logistics service design for CBEC [41]. Tu and Shangguan adopted a revised i-based N-OLI framework for CBEC to discuss the rapid growth, structure, export/import models, and infrastructure and environment of China's CBEC [42].

Based on the literature review, the research on the sustainable development ability of CBEC is unusual. Furthermore, how to make suitable policies for CBEC development is the need to study. Therefore, the purpose of this work is to evaluate China's CBEC sustainable development ability as well as provide references for the related policymakers.

RESEARCH METHODOLOGY

In order to evaluate the sustainable development of CBEC, the DEA method will be employed in this paper. Hence, the introduction to the DEA method will be provided in section 3.1. According to the DEA methodology, we will build the sustainable development evaluation model of china's CBEC in section 3.2. The evaluation data sources will be as well as presented in section 3.2.

Introduction on DEA method

The DEA method is first proposed by Charnes, Cooper, and Rhodes in 1978 to evaluate the relative effectiveness between departments [43]. It combines the knowledge of mathematics, operations research and computer science is a Pareto optimal method for multi-objective decision-making problems with multiple service units input and output [44]. It uses a mathematical programming model to evaluate the relative validity of decision-making units with multiple inputs and outputs [44]. Based on the evaluation structure, an improved scheme is given to achieve the optimal state of each unit. That is, whether DMU is located on the "production frontier" of the production possibilities set, forming data envelopment and establishing a non-parametric optimization model [31], [45], [46]. From the economic point of view, the production frontier is to generalize the production function to the productive aspect, which is composed of the Pareto optimal solution with the minimum input and the largest output [46]. Consequently, as a tool to measure effectiveness, DEA model is suitable for evaluating the effectiveness of multi-unit input and output systems, and is widely used in many fields, for example, the economic system evaluation, inspection of efficiency and performance and measuring technological progress and scale efficiency [47].

In 1978, Charnes, Cooper and Rhodes first proposed the earliest data envelope analysis CCR model for evaluating the relative effectiveness between departments [31]. CCR model is a comprehensive model for

calculating DMU efficiency based on the evaluation of efficiency under the premise of fixed scale efficiency. Based on the CCR model, Banker et al. formed a BCC model by considering scale returns. Nowadays, the BCC model is one of the most widely used DEA models, which is suitable for the analysis of decision-making units under the mode of variable returns to scale [48].

As presented before, most of the existing studies focus on the DEA method in three aspects: the evaluation of the operating economic system, the evaluation of operation process, technological progress and scale efficiency. Among them, the DEA method is widely used in resource allocation, company operation, agriculture and cargo transportation [49], [50]. However, as we introduced in Section 2, some scholars use the analytic hierarchy process, fuzzy comprehensive evaluation method, empirical analysis and other methods to evaluate the sustainable development ability of CBEC, but the implementation of the DEA model is rare. Therefore, this paper mainly uses the DEA method. The evaluation of the sustainable development ability of CBEC provides a reference for the evaluation of the sustainable development ability of CBEC on the basis of making up for the deficiencies of existing theories. The CCR model is a comprehensive model for calculating DMU efficiency based on the evaluation of efficiency under the premise of fixed scale efficiency. Assuming n comparable departments or units, m input indicators and s output indicators, the efficiency evaluation index of DMU_j is as follows:

$$h_j = \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{j=1}^{m} v_{ix_{ij}}}, \quad j = 1,2,3, \cdots, n. \qquad (1)$$

Where: the input quantity of the i^{th} element of the j^{th} decision-making unit; the output quantity of the r^{th} element of the j^{th} decision-making unit; the weight coefficient of the i^{th} input; the weight coefficient of the r^{th} output. x_{ij} and y_{rj} are known data obtained from the data, u_r and v_i are variables.

The weighting of output and the weighting ratio of input can be defined as efficiency. In the linear model of the ratio of output to input, some units that achieve 100% efficiency are called relative efficiency units, while others whose efficiency score is less than 100% are called inefficiency units. When efficiency is taken as objective function and efficiency of different DMUs is not more than 1 as constraint, the CCR model can be obtained.

$$\begin{cases} \max h_j = \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{j=1}^{m} v_{ix_{ij}}} \\ s.t. \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{j=1}^{m} v_{ix_{ij}}} \le 1 \\ u_r \ge 0 \\ v_i \ge 0 \end{cases} \qquad (2)$$

Take the dual form and introduce the slack variable and the non-Archimedean infinitesimal quantity to establish a CCR model with the same scale return:

$$\begin{cases} \min\left[\theta - \epsilon\left(\hat{e}^T s^- + \hat{e}^T s^+\right)\right] \\ \sum_{j=0}^{n} x_j \lambda_j + s^- = \theta x_0 \\ \sum_{j=0}^{n} y_j \lambda_j + s^+ = y_0 \\ \lambda_j \ge 0, j = 1, \cdots, n, \theta \text{ unlimited} \\ s^- \ge 0, s^+ \ge 0 \end{cases} \qquad (3)$$

θ represents a vector of integrated technical efficiency. T represents the transposition of the unit vector e, and λ is a non-Archimedean infinitesimal amount. The x_0 and y_0 are the total amount of the j^{th} DMU input vector and the total output vector, respectively. S^- is the amount of input redundancy, indicating the amount of input required to achieve optimal resource allocation. S^+ is the output shortage, which indicates the optimal output required to achieve resource allocation. Assume θ^0, λ_j^0, $j = 1, \cdots, n$, $s^{0+} s^{0-}$ are the optimal solution, then:

(1) If $\theta^0 < 1$, this decision unit is not a valid unit.

(2) If $\theta^0 = 1$, $e^T s^- + \hat{e}^T s^+ = 0$, the decision unit is strong for DEA.

(3) If $\theta^0 = 1$, $e^T s^- + \hat{e}^T s^+ > 0$, the decision unit is weakly valid for DEA.

In this paper, we employ the BCC model developed by Banker, Charnes and Cooper to measure the efficiency [46]. This model is based on the CCR model and as shown below:

$$\begin{cases} \min\left[\theta - \epsilon\left(\hat{e}^{T}s^{-} + \hat{e}^{T}s^{+}\right)\right] \\ s.t.\sum_{j=1}^{n} x_{j}\lambda_{j} + s^{-} = \theta x_{0} \\ \sum_{j=1}^{n} y_{j}\lambda_{j} - s^{+} = y_{0} \\ \sum_{j=1}^{n} \lambda_{j=1} \\ \lambda_{j} \geq 0, j = 1, \cdots, n, \\ s^{-} \geq 0, s^{+} \geq 0 \end{cases} \quad (4)$$

CBEC sustainable development capability model

1)CBEC sustainable development capability evaluation indicator system

Establishing a reasonable input-output indicator system is the premise and guarantee for accurately evaluating the sustainable development capability of CBEC. When selecting indicators, it is necessary to select the targeted parameters with strong recognition ability and follow the principle of consistency for screening. Therefore, cost-type indicators can be used as input indicators, and benefit-type indicators can be used as output indicators.

2)Indicator selection

We select the 11-year data from 2008 to 2018 to measure the pure technical efficiency, technical efficiency and comprehensive efficiency of China's CBEC. Through the model, China's CBEC sustainable development capability can be evaluated and analyzed. In this paper, the five indicators are divided into two groups including three input indicators and two output indicators. CBEC input and output indicators are as shown in Figure 1:

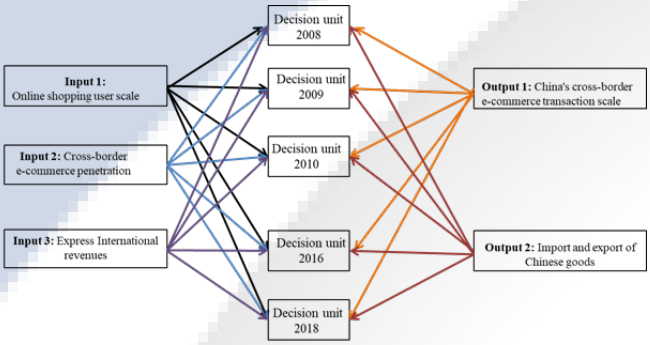

Figure 1. Schematic diagram of the input-output relationship

a) Selection of decision-making unit

In previous research, some researchers use various regions of China as decision-making units to measure the sustainable development capability of CBEC in different regions of China. However, using Chinese regions as the decision-making units only evaluate the regions in a certain year, it could not fully reveal the running trend of CBEC in China. Consequently, this paper defines the annual decision-making unit from 2008 to 2018. Based on the application of CBEC in China, the sustainable development capability of CBEC in China can be directly evaluated by measuring the operational efficiency of the entire industry on a yearly basis. Compared with China's macro-CBEC data, long-term sustainable development capability is more representative.

b) Selection of input variables

- The scale of online shopping users (input 1)

With the rising and development of CBEC in China, the number of online shoppers is one of the important indicators to influence the development of CBEC.

- CBEC penetration (input 2)

E-commerce penetration is an important indicator to evaluate the overall potential market size of China's e-commerce. The growth of CBEC cannot be separated from the good environment of e-commerce. The future growth space of cross-border export e-commerce mainly depends on two points: one is the development space of overseas e-commerce, the other is the development space of Chinese sellers in

overseas e-commerce. The penetration rate of CBEC can reflect the growth space of cross-border export e-commerce.

- Express international revenue (Input 3)

International logistics is one of the important factors affecting the development of CBEC in China. The development logistics platform provides a solid logistics foundation for the development of CBEC. International logistics is an important part of international trade activities. In order to achieve international trade, the sum of the total payments made by the whole logistics process for international trade from the end of production to the end of sales.

c) Selection of Output Variables

- The scale of CBEC transactions in China (Output1)

China's CBEC industry has experienced many years of development and has now formed a huge market scale. The scale of CBEC transactions in China as it is a key indicator to measure the capacity of this industry.

- China's import and export of goods (Output2)

The import and export of goods is a measure of cross-border trade. This indicator can be used to observe the overall scale of a country's foreign trade. As an output variable to measure the actual situation of goods import, it objectively reflects the operational capacity of CBEC.

4) Data sources

The data are as shown in Table 1:

TABLE I. **INPUT-OUTPUT TABLE OF SUSTAINABLE DEVELOPMENT CAPABILITY OF CBEC**

	Input 1	Input 2	Input 3	Output 1	Output 2
2008	0.14	4	1.455	0.8	18
2009	0.267	5.6	1.509	0.9	15.1
2010	0.498	5.9	1.764	1.2	20.2
2011	0.89	7.4	1.655	1.6	23.6
2012	0.7845	8.6	2.056	2	24.4
2013	1.1870	12.2	2.71	2.7	25.8
2014	1.8924	15.9	3.159	3.75	26.4
2015	2.7889	19.2	4.696	4.8	24.57
2016	3.9900	27.5	4.29	6.7	24.3
2017	5.3200	31	5.28	7.6	27.79
2018	6.1000	37.6	5.857	9.1	30.51

Data sources: Research Report on the Development Model of CBEC Industrial Parks, Data Monitoring Report on China's E-commerce Market in 2018, Research Report on China's CBEC in 2018.

MEASUREMENT AND ANALYSIS OF CHINESE CBEC DEVELOPMENT ABILITY

This paper mainly measures the CBEC sustainable development capability from 2008 to 2018 based on the DEA method. We analyze the effectiveness of CBEC in various years from the perspectives of technical efficiency, pure technical efficiency, and scale efficiency, as well as the further, analyze the sustainable development capability of CBEC. The analysis results are shown in Table 2. The results include efficiency analysis are presented in section 4.1 while the projection analysis is presented in section 4.2.

Efficiency analysis

This paper uses data envelopment analysis to measure the operational efficiency of China's CBEC from 2008 to 2018. The results are shown in Table 2. The calculation results include technical efficiency (TE) and its two decomposition terms, pure technical efficiency (PTE) and scale efficiency (SE) respectively. Pure technical efficiency reflects the driving effect of CBEC on the use of innovative technologies and management systems on operational efficiency. Scale efficiency reflects the effectiveness of factor input and operation scale allocation in the business process. This paper will evaluate the sustainable development capability of CBEC in China from the above three perspectives.

TABLE II. **EVALUATION OF CBEC OPERATION EFFICIENCY**

Year	TE	PTE	SE	Scale remuneration
2008	1	1	1	-
2009	0.891	0.981	0.908	Increasing
2010	0.939	0.941	0.998	Decreasing
2011	1	1	1	-
2012	1	1	1	-
2013	0.964	1	0.964	Decreasing
2014	0.989	1	0.989	Decreasing
2015	1	1	1	-
2016	1	1	1	-
2017	1	1	1	-
2018	0.995	1	0.995	Decreasing
Mean	0.980	0.993	0.987	

As shown in Table 2, between 2008 and 2018, the average technical efficiency of CBEC in China is 0.980, and the efficiency value is high. However, there is still room for improvement in the realization of DEA. From the performance of different years, the technical efficiency in the six years of 2008, 2011, 2012, 2015, 2016 and 2017 efficiency values are 1, indicating that China's CBEC enterprises have achieved in the past few years in terms of technological innovation, enterprise management and scale operation. The Pareto optimal state achieves DEA effectiveness. The decomposition of the technical efficiency is pure technical efficiency and scale efficiency. The average values are 0.993 and 0.987 respectively. In the process of driving operational efficiency improvement, the effect of pure technical efficiency is slightly better.

From the technical efficiency perspective as shown in Table 2, it shows a significant downswing in 2009 and 2010, which first fell to 0.891, then rose back to 0.939, and finally returned to the efficiency level of 1. If we take account of the CBEC business environment all over the world, it may be affected by the global financial crisis in 2008. In addition, operational efficiency in 2013 and 2014 experienced another small volatility, which also quickly rebounded to an efficiency level of 1. We can conclude that although China's CBEC technical efficiency is easily interfered by the external environment, it has a strong self-recovery ability, can quickly adjust its own strategy, return to a stable development state, and has a strong sustainable development capability.

From the pure technical efficiency perspective in Table 2, it has dropped significantly in 2009, the efficiency value dropped to 0.981, and continued to fall to 0.941 in 2010, but then resumed and continued to maintain the level of 1, which shows that regardless of the impact of scale factors, China's cross-border enterprises performed well in terms of corporate management and resource utilization efficiency during the overall observation period. The inefficiency of individual years affected the average of the overall observation period.

In terms of scale efficiency changes, the trend of change is consistent with changes in technical efficiency. In addition to the same decline in 2009, there has also been a decline in 2013, and the decline in scale efficiency in 2013 was the reason for the decline in technical efficiency. Combined with the scale of remuneration of cross-border business operations during the observation period, in the relatively ineffective years, except for the increase in scale efficiency in 2009, the other three years showed a decline in scale returns. The diminishing returns to scale mean that cross-border enterprises increase the amount of investment in the operation process and do not exchange the same amount of output. Therefore, enterprises need to appropriately reduce the scale of development and optimize the scale to achieve the best resources and scale. Configuration to improve operational efficiency.

Projection Analysis

As shown in Table 3, a projection analysis of the technical efficiency of cross-border enterprises in 2008-2018 shows that the year with an efficiency value of 1 has achieved the optimal allocation of input and output, and there is no room for improvement. In the non-DEA effective years, the input factors all have redundancy of certain phenomena.

From the input perspective, international express delivery has the least amount of redundancy in 2010 with a suggested reduction of 11.9%. The second-time redundancy rate is the CBEC penetration rate, and the improvement is most likely in 2009, with a reduction of 21%. The most severe redundancy is online shopping users, the highest reduction is 26% in 2010. It is obvious that even if the current scale of operation of CBEC is increasing, it is impossible to blindly increase the input factors, and to solve the problem of inefficiency by expanding the scale, but to conduct a calm and reasonable analysis of enterprise resources, improve resource utilization efficiency, and optimize resources. Use channels to achieve operational efficiency improvements.

TABLE III. **PROJECTION RESULTS OF CHINA'S CBEC OPERATION EFFICIENCY IN 2008-2018**

Year	Input redundancy			Insufficient output	
2008	***Input 1***	***Input 2***	***Input 3***	***Output 1***	***Output 2***
2009	0	0	0	0	0
2010	-0.033	-1.175	-0.029	0	+3.600
2011	-0.128	-0.350	-0.119	0	0
2012	0	0	0	0	0
2013	0	0	0	0	0
2014	0	0	0	0	0
2015	0	0	0	0	0
2016	0	0	0	0	0
2017	0	0	0	0	0
2018	0	0	0	0	0
2008	0	0	0	0	0

Optimization and improvement

According to previous technical efficiency, pure technical efficiency, scale efficiency and projection analysis, CBEC is a non-effective decision-making unit in 2009, 2010, 2013, 2014 and 2018. Considering the existing input factors, the input factors are relatively redundant from the perspective of input. In 2009, the scale of online shopping users, CBEC penetration, international express revenues decreased by 12%, 21% and 19% respectively, to maintain the existing output. The reduction of inputs by 26%, 6% and 7% will still maintain the original output status in 2010. Overall, although there are two years of input and output in the decade is not optimal, but except 2009 and 2010 that has been affected by the economic crisis in 2008, there is a gradual improvement trend and reached the optimal state from 2011 until 2018.

In summary, through the analysis of input and output, from 2008 to 2018, a total of two years of efficiency value is not a valid unit. In the past eight years, China's CBEC enterprises have reached the Pareto optimal state in terms of technological innovation and scale operation. The overall large-scale efficiency change is basically consistent with the change in technical efficiency. From the perspective of investment, the international express has the least amount of redundancy, and the CBEC penetration rate is second. The most serious redundancy is online shopping users. On the whole, China's CBEC has generally shown an optimization trend, and gradually developed towards a good situation of optimization. According to the above-mentioned calculation and analysis of China's CBEC development, it is obvious that china’s CBEC is developed sustainably in the past decade. According to the analysis results, we will give some suggestions at the Micro-level and the Macro-level.

1)Micro-level analysis

In order to develop the china’s CBEC, it is necessary to optimize the input structure and improve the efficiency of resource utilization. From the perspective of input-output, in the case of increasing the operational efficiency of CBEC, it is not possible to blindly increase input factors, improve resource utilization efficiency, and optimize resource allocation to achieve an optimal state. From the above analysis, the main problem of CBEC is that the input is redundant, that is, the input is more but not all converted into an effective output.

From the perspective of the three inputs of the data envelope, the three inputs in the two-year non-effective unit have different levels of input redundancy, indicating that there is room for optimization in

the irrational input structure. Among them, the degree of redundancy in online shopping users and international express is the most serious that is more than 20%. Enterprises should consider the manufacturer in all aspects, according to the destination of the consumer, the attributes of the goods, reasonably divide the responsible area, and choose a reasonable CBEC logistics platform and method. On the basis of understanding the upstream and downstream merchants and customer demand preferences, according to customer requirements and product attributes, choose the delivery method to provide professional services to maximize the use of resources. CBEC is based on online cross-border transactions, including cross-border network marketing, cross-border logistics and distribution, cross-border financial payment, cross-border customer service and other support systems. It is a brand-new and continuously extending industrial chain. CBEC industry chain is inseparable from the support of various talents.

2)Macro-level analysis

Improving the external environment of CBEC needs Government policy support. The government's leading laws and regulations that suit China's national conditions are an important basis for ensuring the healthy development of China's e-commerce industry. In recent years, with the rapid development of CBEC in China, it has become a very important means and means of international trade. However, at present, there are few special laws and regulations on CBEC in China, and there are relatively few legal provisions on e-commerce in the economic and trade field. Existing laws and regulations are more difficult to implement effective supervision of CBEC. Legislation of state organs and policy systems, establishing fair, fair and open market access principles to improve the legal protection of CBEC development, the state should make more efforts to build a healthy and open environment of the Internet, and improve CBEC virtual. The credit system of the market. Relevant policies to promote CBEC development should also be introduced. Improve cooperation and joint regulatory mechanisms for cross-border payments. Since CBEC involves multiple departments, mainly including customs, industry and commerce, taxation and other institutions, the management of cross-border payment institutions has broken the restrictions on foreign exchange payments.

The government leads the establishment of a corporate credit information system that complies with international certification standards, and regularly surveys the credit status of enterprises within the system to ensure the authenticity of credit ratings. In the process of international trade, good credit will definitely be the cross-strait of SMEs in China. E-commerce brings great help and enhances the international visibility of the company. The construction of a good credit information system can promote the development of small and medium-sized CBEC enterprises in China. The state actively establishes economic cooperation relations with foreign countries. Under the current background of global economic integration, countries have begun to actively establish free trade zones and reach free trade agreements with foreign economies to promote the development of international enterprises.

CONCLUSION

As a new trade model, CBEC has the advantage of fast speed and high frequency all over the world. In addition, the trend of CBEC has a profound impact on the long-term development of China's economy. Correspondingly, the development of CBEC has attracted a lot of attention from both the enterprise and the governments. Therefore, this paper uses the DEA method to evaluate the sustainable development capability of china's CBEC. From the analysis result, it is obvious that china's CBEC has experienced a slight decline in 2009 and 2010. It can be interpreted that external factors such as the financial crisis affect china's CBEC development. However, after 2010. From the projection analysis, the input elements show different degrees of redundancy, which has the disadvantage of low resource efficiency. In order to maintain and improve the china's CBEC development, it is necessary to optimize the allocation of resources to make full use of its role to reduce input redundancy and optimize resources at the micro-level. while at the macro level, the government should provide a good external environment for the development of CBEC. In general, the sustainable development of CBEC has shown a good development trend. The recent 8 years all reach the optimal state. It can be concluded that CBEC has a strong sustainable development capability.

REFERENCES

X. Qi, J.H. Chan, J. Hu, and Y. Li, “Motivations for selecting cross-border e-commerce as a foreign market entry mode,” Ind. Mark. Manag, 2020, https://doi.org/10.1016/j.indmarman.2020.01.009.

L. Xiong, Y. Liang, and M. Liu, "Construction and Sustainable Development of the Cross-border E-commerce Economic Regions in China," Atlantis Press, 2017, https:// doi.org/10.2991/ictim-17.2017.49.

Zhang, Y., J. Bian, and W. Zhu, "Trust fraud: A crucial challenge for China's e-commerce market," Electron. Commer. Res. Appl., vol. 12, pp. 299–308, 2013, https://doi.org/ 10.1016/j.elerap.2012.11.005.

M. Giuffrida, R. Mangiaracina, A. Perego, and A. Tumino, "Cross-border B2C e-commerce to Greater China and the role of logistics: a literature review," Int. J. Phys. Distrib. Logist. Manag., 2017, https://doi.org/10.1108/IJPDLM-08-2016-0241.

Y. Wang, Y. Wang, and S.H. Lee, "The effect of cross-border e-commerce on China's international trade: An empirical study based on transaction cost analysis," Sustain., vol. 9, pp. 2028, 2017, https://doi.org/10.3390/su9112028.

W. Xue, D. Li, Y. Pei, and al. Association for Information Systems AIS Electronic Library (AISeL) The Development and Current of Cross-border E-commerce Recommended Citation.

Y. Cui, J. Mou, J. Cohen, Y. Liu, and K. Kurcz, "Understanding consumer intentions toward cross-border m-commerce usage: A psychological distance and commitment-trust perspective," Electron. Commer. Res. Appl., Vol. 39, pp. 100920, 2020 https://doi.org/10.1016/j.elerap.2019.100920.

J.H. Han, H.M. Kim, "The role of information technology use for increasing consumer informedness in cross-border electronic commerce: An empirical study," Electron. Commer. Res. Appl., vol. 34, pp. 100826, 2019, https://doi.org/10.1016/j.elerap. 2019.100826.

G. Li, and N. Li, "Customs classification for cross-border e-commerce based on text-image adaptive convolutional neural network," Electron. Commer. Res., vol. 19, pp. 779–800, 2019, https://doi.org/10.1007/s10660-019-09334-x.

G. Gaulier, F. Lemoine, and D. Ünal-Kesenci, "China's emergence and the reorganisation of trade flows in Asia," China Econ. Rev., vol. 18, pp. 209–243, 2007, https://doi.org/10.1016/j.chieco.2007.02.008.

C. Cambini, A. Giusti, and M. Faccini, "Innovazione digitale e Cross-border e-commerce in Cina Digital innovation and Cross-border e-commerce in China," 2018.

P. Jiang, and S.K. Balasubramanian, "An empirical comparison of market efficiency: Electronic marketplaces vs. traditional retail formats," Electron. Commer. Res. Appl., vol. 13, pp. 98–109, 2014, https://doi.org/10.1016/j.elerap.2013.11.003.

National Engineering Laboratory, 2017 China Cross-Border E-Commerce (Export B2B) Report, 2017.

J. Yang, N. Yang, and L. Yang, "The Factors Affecting Cross-border E-commerce Development of SMEs: An Empirical Study," Wuhan International Conference on e-Business (Whiceb), 2014.

Y. Hongfei, National Report on E-Commence Development in China, 2017.

Y. Fang, "Current Situation, Obstacles and Solutions to China's Cross-Border E-Commerce," Open J. Soc. Sci., vol. 05, pp. 343–351, 2017, https://doi.org/10.4236/jss. 2017.510028.

Ali Research, "Breaking down borders: SMEs' e-commerce business through free trade zones – EURObizEURObiz," 2020.

CIConsulting, 2018-2022 China Cross-border E-commerce Market In-depth Investigation and Investment Prospect Forecast Report, 2018.

Shanghai Academy of Social Sciences, E-commerce Development Report of the Small and Medium Sized Enterprises of BRICS Countries, 2017.

S. Dariusz, "Development Factors for Cross-Border B2C E-Commence in the Word and in Poland," Acta Sci. Pol. – Oeconomia, vol. 18, pp. 111–119, 2020, https://doi.org/ 10.22630/aspe.2019.18.3.38.

Q. Fan, "An exploratory study of cross border E-commerce (CBEC) in China: Opportunities and challenges for small to medium size enterprises (SMEs)," Int. J. E-entrepreneursh. Innov., vol. 9, pp. 23–29, 2019, https://doi.org/10.4018/IJEEI.2019010103.

M. Majcherczyk, and B. Shuqiang, "Digital Silk Road - The Role of Cross-Border E-Commerce in Facilitating Trade," J. WTO China 9, 2019.

P.O. Ott, UNCITRAL – United Nations Commission On International Trade Law. A Concise Encycl. United Nations, 2010, https://doi.org/10.1163/ej.97890 04180048.i-962.595.

X. Meng, Study on Combining of E-commerce and E-marketing, 2010, https://doi.org/10.4304/jsw.5.5.546-553.

China E-Business Research Center, China CBEC Talents Report, 2015.

F. Dezan, Associates, S.&, Cross Border e-Commerce in China, Issue, 2018.

V. Kumar, and G. Raheja, "Business To Business (B2B) and Business To Consumer (B2C) Management," Int. J. Comput. Technol. Vol. 3, pp. 447–451, 2012.

A. Sen, “A Survey of sustainable development: social and economic dimensions,” Choice Rev., Online vol. 39, pp. 1693-1693, 2001, https://doi.org/10.5860/choice.39-1693.

W. Commission on Environment, Report of the World Commission on Environment and Development: Our Common Future Towards Sustainable Development 2. Part II. Common Challenges Population and Human Resources, 1987.

A.D. Basiago, “Methods of defining ‘sustainability.’ Sustain,” Dev. Vol. 3, pp. 109–119, 1995, https://doi.org/10.1002/sd.3460030302.

P. Zhang, X. Liu, F. Yuan, Z. Zhang, and M. Trends, “Annual Report on China’s Economic Growth: Macroeconomic Trends and Outlook [WWW Document],” 2016, https://doi.org/10.1007/978-3-662-49050-1_1.

D. Jutla, P. Bodorik, and Y. Wang, “A step towards a suite of E-commerce benchmarks, in: Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics),” Springer Verlag, pp. 419–428, 2000, https://doi.org/10.1007/3-540-44463-7_37.

G. Kaisara, and S. Pather, “The e-Government evaluation challenge: A South African Batho Pele-aligned service quality approach,” Gov. Inf. Q., vol. 28, pp. 211221, 2011, https://doi.org/10.1016/j.giq.2010.07.008.

Y. Miao, R. Du, J. Li, and J.C. Westland, “A two-sided matching model in the context of B2B export cross-border e-commerce,” Electron. Commer. Res., vol. 19, pp. 841–861, 2019.

B. Honig, “Entrepreneurship and SME Management Across Africa: A Perspective and a Short Review,” pp. 213–218, 2016, https://doi.org/10.1007/978-981-10-1727-8_13.

S.M.B. Thatcher, and W. Foster, “B2B e-commerce adoption decisions in Taiwan: The interaction of organizational, industrial, governmental and cultural factors,” Proc. 36th Annu. Hawaii Int. Conf. Syst. Sci. HICSS, 2003, https://doi.org/ 10.1109/HICSS.2003.1174620.

R. Sinkovics, M. Yamin, and M. Hossinger, “Cultural adaptation in cross border e-commerce: A study of German companies,” J. Electron. Commer. Res., vol. 8(4), pp. 221-235, 2007.

P. He, S. Zhang, and C. He, “Impacts of logistics resource sharing on B2C E-commerce companies and customers,” Electron. Commer. Res. Appl., vol. 34, pp. 100820, 2019, https://doi.org/10.1016/j.elerap. 2018.100820.

P. Goyal, Z. Rahman, A.A. Kazmi, “Corporate sustainability performance and firm performance research: Literature review and future research agenda,” Manag. Decis, 2013, https://doi.org/10.1108/00251741311301867.

T. Sueyoshi, and M. Goto, “Resource utilization for sustainability enhancement in Japanese industries,” Appl. Energy., vol. 228, pp. 2308–2320, 2018, https://doi.org/10.1016/ j.apenergy.2018.07.031.

Y.H. Hsiao, M.C. Chen, and W.C. Liao, “Logistics service design for cross-border E-commerce using Kansei engineering with text-mining-based online content analysis,” Telemat. Informatics, vol. 34, pp. 284–302, 2017, https://doi.org/10.1016/j.tele. 2016.08.002.

Y. Tu, and J.Z. Shangguan, “Cross-border e-commerce: A new driver of global trade, in: Emerging Issues in Global Marketing: A Shifting Paradigm,” Springer International Publishing, pp. 93–117, 2018, https://doi.org/10.1007/978-3-319-74129-1_4.

J.S. Liu, L.Y.Y. Lu, W.M. Lu, B.J.Y. Lin, “Data envelopment analysis 1978-2010: A citation-based literature survey,” Omega (United Kingdom) vol. 41, pp. 3–15, 2013.

A.I. Ölçer, “A hybrid approach for multi-objective combinatorial optimisation problems in ship design and shipping,” Comput. Oper. Res., vol. 35, pp. 2760–2775, 2008, https://doi.org/10.1016/j.cor.2006.12.010.

W.F. Bowlin, “Measuring Performance: An Introduction to Data Envelopment Analysis (DEA),” J. Cost Anal., vol. 15, pp. 3–27. 1998.

W.W. Cooper, T R.G. hompson, and R.M. Thrall, “Introduction: Extensions and new developments in DEA,” Ann. Oper. Res., vol. 66, pp. 3–45, 1996 https://doi.org/10.1007/ BF02125451.

F.H. Lotfi, S.E. Najafi, and H. Nozari, “Data envelopment analysis and effective performance assessment, Data Envelopment Analysis and Effective Performance Assessment,” IGI Global., 2016, https://doi.org/10.4018/978-1-5225-0596-9.

J. Zhang, Y. Liu, Y. Chang, and L. Zhang, “Industrial eco-efficiency in China: A provincial quantification using three-stage data envelopment analysis,” J. Clean. Prod., vol. 143, pp. 238–249, 2017, https://doi.org/10.1016/j.jclepro.2016.12.123.

E. Bolandnazar, A. Keyhani, and M. Omid, “Determination of efficient and inefficient greenhouse cucumber producers using Data Envelopment Analysis approach, a case study: Jiroft city in Iran,” J. Clean. Prod., Vol. 79, pp. 108–115, 2014, https://doi.org/10.1016/j.jclepro.2014.05.027.

A. Fathi, and R.F. Saen, “A novel bidirectional network data envelopment analysis model for evaluating sustainability of distributive supply chains of transport companies,” J. Clean. Prod., 184, 696–708. 2018https://doi.org/10.1016/j.jclepro. 2018.02.256.