Asian Journal of Innovation and Policy (2022) 11.2:238-257
DOI: http//dx.doi.org/10.7545/ajip.2022.11.2.238

Analysis of the Development of Cross-border E-commerce in China's Manufacturing Industry[1]

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Abstract As the global epidemic continues to worsen, the pressure on the supply chain is also increasing. In this context, Internet shopping has ushered in new development opportunities. Under the influence of globalization, the development of cross-border e-commerce (CB-EC) is particularly remarkable. As China is a big manufacturing country, the growth of CB-EC is a significant opportunity for Chinese goods to enter the international market. Therefore, this paper comprehensively analyzes the current situation of the integrated development of China's manufacturing industry and CB-EC from four aspects: the operation mode, development mode, policy environment, and development prospect of CB-EC in China's manufacturing sector. This paper constructs an evaluation system including 19 secondary indicators to rank the CB-EC development environment of 30 provinces in China that have established comprehensive pilot zones of CB-EC.

Keywords Manufacturing cross-border e-commerce; International market; Provincial evaluation; Factor analysis

I. Introduction

With the initial effective control of COVID-19 in China, China's manufacturing industry is recovering rapidly, which not only has a positive impact on easing the pressure on the global supply chain but also provides an important opportunity for Chinese products to enter the world market. As a new way for Chinese products to go to the world, cross-border e-commerce

Submitted, January 28, 2022; 1st Revised, May 26, 2022; Accepted, July 11, 2022
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[1] Cross-border e-commerce refers to an international business activity in which trading entities belonging to different customs territories reach transactions through e-commerce platforms, conducting electronic payment, and settlement, and delivering goods through cross-border e-commerce logistics and remote warehousing to complete the transaction.

(CB-EC) has attracted the attention of significant operators and manufacturing enterprise operators in China in recent years. Many Chinese manufacturing business operators have used major CB-EC platforms to sell their products worldwide and have gained considerable profits. However, the development history of CB-EC in China is relatively short, and many aspects are still in the exploratory stage, among which the construction of the development environment of CB-EC is the most essential and fundamental aspect. Promoting the optimization of the development environment of CB-EC in China's manufacturing industry is an important issue facing the development of CB-EC in China manufacturing industry.

II. Literature review

From the perspective of the development of China's manufacturing industry, it has gone through stages such as "scratch," "weak to strong," and "system to wisdom." In its research, it is mentioned that the rapid development of China's manufacturing industry began with implementing the "reform and opening-up" policy. In the early stage of reform and opening-up, private capital gradually entered the market. Due to the lack of essential production factors such as capital, technology, and equipment, China has introduced many foreign resources. This situation is called "three supplies and one supplement," namely "processing supplied materials," "assembling supplied parts," "processing supplied samples," and "compensation trade" (Li, 2020; Zhao, 2019). With the blessing of China's demographic dividend and abundant resources, the " three supplies and one supplement " policy has been effectively implemented in China, and many foreign production factors have poured into China. With the spillover effect of foreign resource investment, China's manufacturing industry has accumulated a large amount of capital and technology and gradually began to step into the road of independent development. In 2001, China was admitted to the WTO, which provided an important opportunity for Chinese products to enter the international market. Since then, until 2011, China has developed into the world's largest exporter by its continuously improving industrial system. By the beginning of 2021, China's industrial added value had increased from 23.5 trillion to 31.3 trillion yuan, making it the world's largest manufacturing country for 11 consecutive years (Huaxia, 2021).

However, in contrast to the position of China's manufacturing industry in the global supply, it was in the downstream place before China implemented the transformation and development strategy in 2015, which shows to a great extent that the development of China's manufacturing industry is "large but not strong." At the same time, due to the lack of after forcing of technological innovation, the product renewal iteration of China's manufacturing industry is

not timely, resulting in significant overcapacity to a certain extent. Recently, the demographic dividend has been gradually disappearing with the gradual acceleration of China's economic development. Under this background, the traditional manufacturing industry is challenging to survive under the original business model and development concept (Zhang and Chen, 2019). From the perspective of changes in the global manufacturing pattern, the western developed countries represented by the United States, after experiencing the economic crisis in 2008, to boost domestic economic development, continue to accelerate the implementation of the strategy of manufacturing returning to their own countries, and further strengthen the competitiveness of their manufacturing products in the international market (Liu et al., 2019). In recent years, with the adjustment of the global supply chain and the increasing investment of significant manufacturing countries in the third-party international market, the manufacturing industry in Southeast Asian countries represented by Vietnam, Indonesia, Malaysia, and other countries has developed very rapidly. Relying on low-cost production materials has formed an inevitable squeeze on the development of China's traditional manufacturing industry.

Around 2015, China began implementing the "Internet +" strategy, and "Internet + manufacturing" undoubtedly injected new momentum into transforming and upgrading China's traditional manufacturing industry. Today, the Internet has become an important channel for China's manufacturing business entities to expand overseas markets, enhance the international image of brands, and then realize the global strategic layout, which has had a profound impact on the "going out" of China's manufacturing enterprises (Ma, 2019; Hu, 2017). CB-EC not only creates new ideas and methods for China's manufacturing enterprises to "go global" but also provides a new model, expanding the traditional foreign trade B2B model to the B2C model and then evolving into M2B2C. These changes will further optimize the global supply chain layout and shape a new business model (Li, 2015; Xu, 2015).

The CB-EC has cross-cultural, cross-regional, and intangible characteristics. Compared with domestic e-commerce, the goods traded by CB-EC result in a more complex process to complete a transaction. Compared with traditional international trade, CB-EC has higher transaction frequency, low single transaction amount, and high requirements for logistics timeliness. The implementation characteristics determine significant differences between CB-EC and traditional international trade (Chan and Luo, 2020). On the one hand, these differences bring difficulties to business entities and consumers in the transaction process. On the other hand, they also put ahead higher regulatory requirements for tax, customs, and other regulatory authorities (Su, 2021).

III. Development status of cross-border e-commerce in the manufacturing industry

1. Operation mode of cross-border e-commerce in the manufacturing industry

Currently, CB-EC in the manufacturing industry is mainly carried out in consignment and self-operation. The CB-EC of the manufacturing industry was initially carried out in the consignment. With the changes in external conditions, such as the simplification of the operation process of major CB-EC platforms and the optimization of customs supervision policies, the technical threshold of the business model has been reduced to a certain extent. The business entities of the manufacturing industry further pursue internal development needs such as capital return, and the operation mode has gradually changed from consignment to self-operation (Chen and Yang, 2020).

In the consignment mode, the division of labor between manufacturing operators and CB-EC operators is clear. The manufacturing business entity is responsible for designing and developing goods, patent applications, handling various licenses, and product inspection and testing. After meeting the access requirements of import destination countries or the requirements of commodity merchants on CB-EC platforms, the reliable and efficient business entity is required to carry out subsequent commodity displays, shelves, transportation, sales, and after-sales links. Under this mode, the manufacturing business entity is equivalent to outsourcing all the CB-EC sales business to the CB-EC business entity. The consignment mode can save operating costs to carry out CB-EC sales and enable them to invest more resources in product optimization iterations. And it avoids operating risks caused by large-scale return and exchange, cross-border payment, logistics, etc. Its disadvantage is that it can not directly contact end consumers, resulting in weak control over the end consumer market. At the same time, it will also lose some additional benefits of products, thus weakening its ability to enter the global market in the future.

In the self-operated mode, the manufacturing business entities generally complete the sales processes of self-produced goods on the CB-EC platform by establishing an independent department of CB-EC operations. According to the field research results, the proportion of manufacturing business entities that operate self-produced goods in China is relatively low. It is necessary to transform CB-EC in the manufacturing industry from consignment to self-operated mode. In general, most CB-EC chambers in the manufacturing industry set up their CB-EC stores or operate their independent sites. To pursue higher product exposure and improve sales efficiency, they will conduct agency sales business with some experienced and powerful operators.

The advantage of the self-supporting mode is that the manufacturing business entities have a more accurate grasp of product positioning, characteristics, application scenarios, and other information, which is conducive to improving the conversion rate of product display. At the same time, they can receive the feedback information of end consumers for the first time and provide a more helpful reference for product optimization (Lee and Yeon, 2021). While operating stores independently, enterprises can create more exposure for their brands, improve the international popularity of brands, and lay a market foundation for entering the global market in large quantities in the future. The disadvantage is that whether it is an operation platform store or an independent station, a large amount of capital investment will be required in the early stage to complete the links, such as flow improvement, talent recruitment, and daily maintenance. At the same time, individual posts should be set up to optimize after-sales service. These operations will bring tremendous pressure to the day-to-day operation of the enterprise.

2. Development model of cross-border e-commerce in the manufacturing industry

The CB-EC of China's manufacturing industry can be divided into import and export modes according to the logistics flow direction. The import mode is mainly B2C and overseas purchasing, while the export mode includes B2B, B2C, C2C, and M2B2C, of which B2B and B2C are the main modes. According to the data released by the China business intelligence network, the change in the proportion of China's CB-EC overall transaction volume from 2016 to 2020 is shown in Figure 1 (Qiu and Yang, 2021):

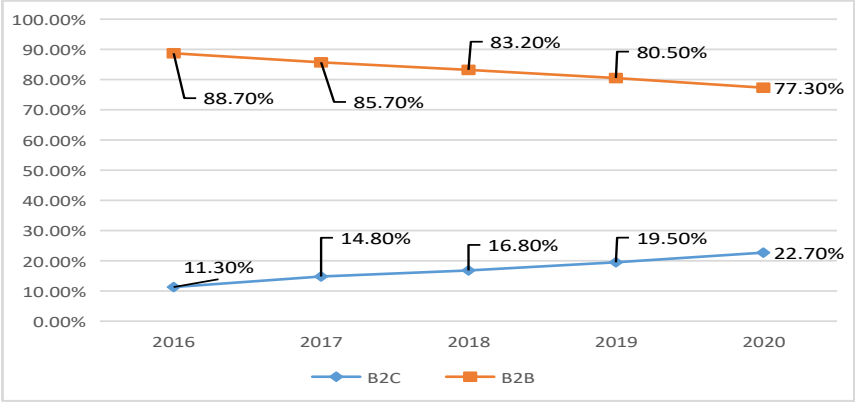


Figure 1 changes in the proportion of overall transaction volume of cross-border e-commerce in China from 2016 to 2020

From the situation reflected in the data above, the proportion of transaction volume of China's CB-EC B2C model has been steadily increasing in the past five years. This situation shows that Chinese consumers' purchasing power is growing and that China's CB-EC operators are increasingly selling goods directly to end consumers through CB-EC platforms.

Under the B2B mode, the representative CB-EC platforms used in China are mainly Alibaba international stations, characterized by large single transaction volumes and few transactions, which is close to the characteristics of traditional import trade. In the B2C mode, Amazon, eBay, and Wish, which started earlier, and Lazada and Shape, which have sprung up in recent years, are the main ones. Their transaction characteristics are that they directly face the end consumers, with small single transaction volume, high transaction frequency, high logistics requirements, and scattered orders, which is very different from the traditional import trade. The C2C and M2B2C modes mainly focus on the personal goods transaction module and specific FMCG module launched by large CB-EC platforms. Its transaction characteristics are similar to the B2C mode.

Due to the increasing competition between CB-EC platforms and the growing supervision of CB-EC trading commodities in various countries, some CB-EC platforms have the problem of transferring the operating pressure to the business entities of shops. At the same time, with the gradual expansion of the influence of new drainage tools such as TikTok overseas version and Facebook short video, all kinds of operators began to explore the development mode of independent website construction. Compared with stores using CB-EC platforms, independent station operation also means high investment, risk, and return for operators (Wang et al., 2017).

3. Policy environment of cross-border e-commerce in the manufacturing industry

Recently, the overall development of CB-EC has been very rapid, and the volume of commodity transactions has repeatedly reached new highs. Driven by this form of development, China's relevant infrastructure construction has been continuously optimized, various preferential policies have been constantly implemented and effectively, and national pilot projects have been rapidly launched. On the whole, China is at the world's advanced level regarding transaction scale, customs supervision, tax preference, logistics support, and process simplification.

Taking the national support policies as an example, from 2014 to the first half of 2021, China issued 20 policy documents related to the development of

the CB-EC industry, as shown in Table 1 below. On the one hand, it reflects the attention paid by various national departments to developing the CB-EC industry. On the other hand, it can also reflect the optimization efficiency of the macro environment for developing CB-EC in China in recent years.

Table 1 Summary of China's national cross-border e-commerce policy documents from 2014 to 2021

No.	Implementation time	Issuing unit	File name	Main content
1	2014.02	General Customs Administration	*Announcement on adding the code of customs supervision mode*	Add 9619 supervision mode, "cross border trade e-commerce"
2	2014.07	General Customs Administration	*Announcement on adding the code of customs supervision mode*	Add 1210 supervision mode "bonded cross-border trade e-commerce"
3	2015.05	General Customs Administration	*Notice on adjusting the requirements of customs operation time and customs clearance time limit for cross-border trade e-commerce supervision*	Shift to 7 * 24-hour operation
4	2015.06	General Customs Administration	*Guidance on promoting the healthy and rapid development of cross-border E-commerce*	Put forward 12 opinions
5	2015.09	General Customs Administration	*Letter on strengthening the supervision of bonded import of cross-border e-commerce online shopping*	Stop the cross-border bonded business established by local governments
6	2016.04	General Customs Administration	*Notice on printing and distributing the system and measures that can be copied and promoted by the customs in the comprehensive pilot zone of cross-border E-commerce*	10 replication and promotion measures in the comprehensive test area

7	2016.04	Ministry of finance, General Administration of customs and State Administration of Taxation	*Notice on cross border e-commerce retail import tax policy*	Limit value, tax calculation, taxpayer, etc
8	2018.03	Ministry of commerce	Notice on doing a good job in e-commerce statistics	Strengthen the implementation of e-commerce statistics
9	2018.04	General Customs Administration	*On regulating the registration management of e-commerce payment enterprises*	Further standardize customs cross-border e-commerce supervision
10	2018.07	The State Council	*Reply on agreeing to establish cross-border e-commerce comprehensive pilot zones in 22 cities including Beijing*	Set up a new batch of comprehensive test areas and improve the supervision system
11	2018.08	Intellectual Property Office	*Notice on deepening the special rectification of intellectual property protection in the field of e-commerce*	Strengthen the rectification of key areas
12	2018.09	Ministry of finance, State Administration of Taxation, Ministry of Commerce and General Administration of Customs	*Notice on tax policy of retail export goods in cross border e-commerce comprehensive pilot zone*	Try out the tax exemption policies of value-added tax and consumption tax
13	2018.11	Ministry of finance, State Administration of Taxation, Ministry of Commerce and General Administration of Customs	*Notice on improving the tax policy of cross-border e-commerce retail import*	The tax should be adjusted in three aspects
14	2018.11	General Customs Administration	*Announcement on matters related to real-time access to original payment data of enterprises on cross-border e-commerce platforms*	The cross-border e-commerce platform is required to open the original payment data

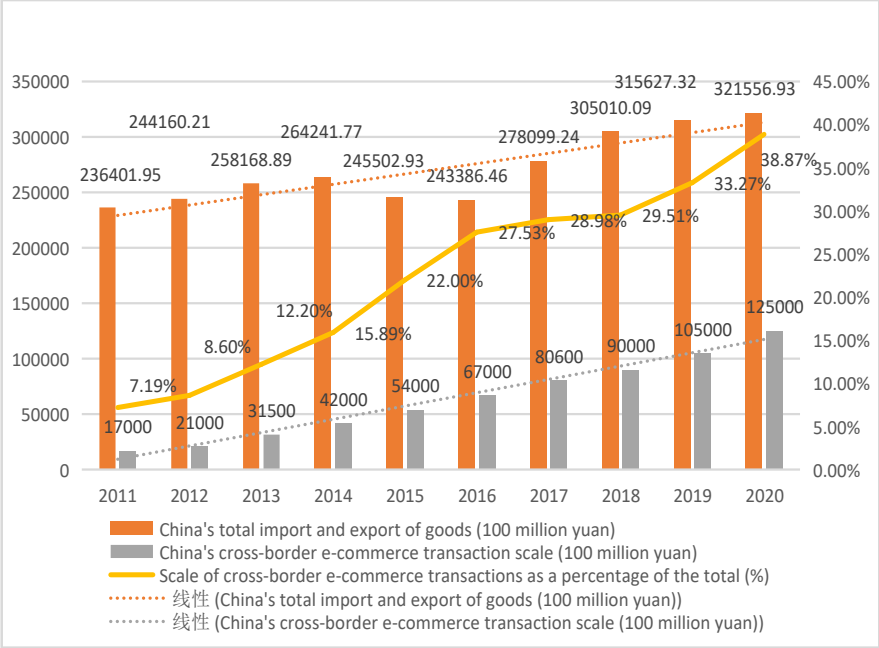
15	2018.12	General Administration of market supervision and Administration	*Opinions on doing a good job in the registration of e-commerce operators*	E-commerce operators shall not carry out offline business activities
16	2018.12	General Customs Administration	*Public notice on the supervision of cross-border e-commerce banning the sale of import and export commodities*	Further comprehensively stipulate the management of cross-border e-commerce enterprises
17	2019.01	The Ministry of Finance	*Announcement on adjusting the list of retail imported goods of cross-border E-commerce*	Positive list update
18	2019.03	The State Council	*Government work report*	Reform and improve support policies for new business forms such as cross-border e-commerce
19	2020.06	General Customs Administration	*Announcement on carrying out the pilot of cross-border e-commerce enterprise to enterprise export supervision*	Add B2C export exclusive supervision codes 9710 and 9810 to promote the stable development of import and export
20	2021.03	The State Council	*Government work report*	New cross-border e-commerce development modes

Source: collected from public information on Chinese government websites

4. Development prospect of cross-border e-commerce in the manufacturing industry

Since China launched the electronizations of import and export trade at the end of the last century, it has experienced industrial upgrading from information services to online transactions and CB-EC (Yu, 2021). The proportion of the total import and export transactions completed through the

CB-EC model in the total import and export trade continues to increase, as shown in Figure 2 below:



Source: compiled by China National Bureau of statistics and public data on the Internet

Figure 2 changes in the scale of China's import and export trade and cross-border e-commerce transactions

From the situation reflected in the above figure, the overall scale of China's foreign trade transactions has shown an upward trend in the past decade, expanding from 23640.195 billion yuan in 2011 to 32155.693 billion yuan in 2020, with an increased rate of 36%. From 2014 to 2016, China implemented the transformation and development strategy and comprehensively promoted the measures of "three removals, one reduction, and one compensation." Some manufacturing enterprises that did not meet the requirements of the national development strategy began to "close, stop, merge and transfer." To some extent, it leads to the short-term decline of China's import and export trade scale. The scale of CB-EC transactions has continued to expand, with a growth rate of 635.29% over the past decade.

More noteworthy is that the proportion of China's CB-EC transactions in the overall foreign trade scale has also expanded from 7.19% in 2011 to 38.87% in

2020. It can be seen that the future development space of CB-EC in China's manufacturing industry is still vast. Combined with the macro policy environment optimization process sorted out above, the manufacturing business entities still have excellent prospects in the future development of CB-EC.

IV. Provincial evaluation of China's cross-border e-commerce development environment

1. Construction of an environmental assessment system for cross-border e-commerce development and data source selection

Combined with the above analysis results, China's manufacturing CB-EC will still usher in a significant growth trend in the future, and the industrial development environment is the basis for the future development of China's manufacturing CB-EC. Based on this situation, the researchers will build an environmental assessment system for the growth of CB-EC in China's provincial, and regional manufacturing industry. China has a vast territory and rich resources. At the same time, it also determines significant development differences among regions to a certain extent. Building an evaluation system for the development environment of manufacturing CB-EC in 30 provinces, China has established CB-EC pilot zones. It can make us understand the regional differences in the development environment of China's manufacturing CB-EC and provide an important reference for subsequent in-depth research.

This study selects three aspects of the social governance environment, economic development environment, and supportive environment of related industries as benchmark indicators, corresponding to 17 secondary evaluation indicators. The specific contents are shown in Table 2:

Table 2 construction of evaluation system and index description

Datum layer	Index layer	Interpretation and calculation method of evaluation index
Social environment	A_1 Environmental governance	It reflects the intensity of regional environmental governance, expressed in terms of the investment cost of environmental governance and the proportion of regional GDP
	A_2 Educational investment	It reflects the intensity of regional education investment, expressed in terms of education investment and the proportion of regional GDP
	A_3 Urban Road area per capita	It is used to indicate the traffic construction in the area.
	A_4 Protection of employees' rights and interests	Expressed by the Number of trade union grass-roots organizations in the region
	A_5 Number of undergraduate graduates	Used to indicate the talent support level available in the region
Manufacturing supporting environment	A_6 Added value of fixed asset investment in the manufacturing industry over the previous year.	Used to indicate the investment in the development of the regional manufacturing industry
	A_7 Innovation ability of industrial products	It refers to the product innovation capability of cross-border e-commerce of the manufacturing industry in the region, expressed in terms of R & D investment expenses of industrial entities above the designated size.
	A_8 Industrial Development	Expressed by the proportion of secondary industry output value in regional GDP
Economic environment	A_9Per capita disposable income of residents	Reflect the demand level of people in the region for cross-border e-commerce
	A_{10}Economic Openness	Reflect on the development space of cross-border e-commerce in the regional manufacturing industry
	A_{11} Digital economy index	Digital economy support reflecting the cross-border e-commerce development of the regional manufacturing industry
	A_{12} Regional import and export volume	Reflecting the export-oriented economic foundation of cross-border e-commerce development of the regional manufacturing industry
Facility environment	A_{13} Number of ports	Reflect the customs clearance capacity of cross-border e-commerce goods of the manufacturing industry in the region
	A_{14} Number of express points	Reflect on the logistics infrastructure level of cross-border e-commerce of the manufacturing industry in the region

	A_{15} Number of computers per 100 people	Reflect the infrastructure level of cross-border e-commerce in the manufacturing industry in the region
Industrial basic environment	A_{16} Number of enterprises with e-commerce transactions	Reflect the vitality of cross-border e-commerce industry of manufacturing industry in the region
	A_{17} E-commerce transaction volume	Reflect on the scale of cross-border e-commerce industry of manufacturing industry in the region
	A_{18} Number of cross-border e-commerce comprehensive pilot areas	Reflect on the level of cross-border e-commerce industry of manufacturing industry in the region
	A_{19} Number of websites owned by enterprises	Reflect on the electronic informatization level of cross-border e-commerce in the manufacturing industry in the region

Among the indicators listed in the above table, the data sources of A1, A2, A3, A4, A5, A6, a7, A8, A9, a11, A14, A15, a16, A18, and A19 indicators are China Statistical Yearbook. The data sources of a11 indicators are China's urban digital economy development report (2021). The data sources of A13 indicators are the official website of the China Port Association. The data sources of A14 indicators are the official website of Aicha express. A18 indicator data comes from the Central People's Government of the people's Republic of China portal website. The selection criteria for provinces is that, at present, the Chinese government has approved the establishment of CB-EC pilot zones in a total of 30 provinces, excluding Hong Kong, Macao, Taiwan, and Tibet.

2. Empirical analysis process

This study mainly uses factor analysis to empirically analyze the development environment of CB-EC in 30 provinces of China.

The first is the standardized processing and inspection of data. The original data are standardized using the range method, and then the standardized data are tested by the KMO method and Bartlett ball test method. The results show that the KMO value is 0.785, the approximate chi-square value is 937.088, and the p-value is 0.000. Overall, the data set selected in this study is more suitable for exploratory factor analysis.

Then extract the common factor. Import the standardized data set into the data analysis software SPSS, and then the results of the output variance interpretation rate are shown in Table 3 below:

Table 3 results of variance interpretation rate

Factor No.	Characteristic root			Interpretation rate of variance before rotation			Interpretation rate of variance after rotation		
	Characteristic root	Variance interpretation rate%	Cumulative%	Characteristic root	Variance interpretation rate%	Cumulative%	Characteristic root	Variance interpretation rate%	Cumulative%
1	10.833	57.016	57.016	10.833	57.016	57.016	8.889	46.784	46.784
2	3.588	18.885	75.901	3.588	18.885	75.901	4.489	23.626	70.41
3	1.729	9.101	85.003	1.729	9.101	85.003	2.773	14.593	85.003
4	0.895	4.711	89.714	-	-	-	-	-	-
5	0.611	3.217	92.931	-	-	-	-	-	-
6	0.38	1.998	94.93	-	-	-	-	-	-
7	0.257	1.35	96.28	-	-	-	-	-	-
8	0.248	1.306	97.586	-	-	-	-	-	-
9	0.136	0.717	98.303	-	-	-	-	-	-
10	0.094	0.493	98.795	-	-	-	-	-	-
11	0.074	0.387	99.183	-	-	-	-	-	-
12	0.059	0.308	99.491	-	-	-	-	-	-
13	0.029	0.154	99.645	-	-	-	-	-	-
14	0.027	0.143	99.788	-	-	-	-	-	-
15	0.019	0.102	99.891	-	-	-	-	-	-
16	0.011	0.058	99.949	-	-	-	-	-	-
17	0.005	0.026	99.975	-	-	-	-	-	-
18	0.003	0.015	99.99	-	-	-	-	-	-
19	0.002	0.01	100	-	-	-	-	-	-

According to Table 3, the characteristic root values of factor numbers 1, 2, and 3 are more significant than 1. After extracting three common factors, the cumulative variance interpretation rate is 85.003%, and the amount of information loss is small. At the same time, the change degree of variance interpretation rate before and after rotation is insignificant, and the cumulative interpretation rate does not change, indicating that selecting three common factors can explain the useful information of 17 evaluation indicators. The results of rotating the factor load matrix by Caesar's normalization maximum variance method are shown in Table 4:

Table 4 load factor after rotation

Name	Factor load factor			Common degree (common factor variance)
	Factor1	Factor 2	Factor 3	
Proportion of environmental governance in GDP	-0.318	-0.16	-0.82	0.799
Number of enterprises with e-commerce transactions	0.887	0.321	0.225	0.94
Proportion of education expenditure in GDP	-0.377	-0.342	-0.695	0.742
Growth of fixed asset investment in the manufacturing industry over the previous year (%)	0.014	0.002	-0.829	0.688
Number of graduates of related majors under undergraduate caliber	0.709	-0.239	0.462	0.773
Per capita disposable income of residents	0.192	0.916	0.203	0.916
Economic Openness	0.38	0.85	0.244	0.927
Number of computers per 100 people (set)	-0.129	0.898	-0.224	0.874
Digital economy index	0.764	0.505	0.312	0.936
Number of express points	0.919	0.208	0.245	0.948
Number of ports	0.664	0.041	-0.119	0.456
Number of trade union grass-roots organizations (10000)	0.802	-0.205	0.385	0.833
Number of websites owned by the enterprise	0.942	0.238	0.197	0.983
Rd funds above Designated Size (10000 yuan)	0.954	0.132	0.178	0.96
Proportion of secondary industry output value in GDP (100 million yuan)	0.94	-0.019	0.298	0.973
E-commerce sales (100 million yuan)	0.607	0.732	0.138	0.924
Number of cross-border e-commerce pilot areas	0.936	-0.015	0.068	0.881
Total regional import and export (100 million yuan)	0.842	0.499	0.075	0.963
Urban Road area per capita	0.109	-0.785	-0.083	0.635

According to Table 4, the common factor variance of the evaluation indicators selected in this study is more significant than 0.4. The results of classifying, defining, and naming the evaluation indicators according to the extraction results of common factors and the theme of this study are as shown in Table 5 below:

Table 5 economic meaning and vocabulary of factors

component	High load index	Naming of economic meaning
F1	A_4、A_7、A_8、A_{13}、A_{14}、A_{16}、A_{18}、A_{19}	Core development environment of cross-border e-commerce in the manufacturing industry
F2	A_3、A_9、A_{10}、A_{11}、A_{12}、A_{15}、A_{17}	Economic environment for cross-border e-commerce development of the manufacturing industry
F3	A_1、A_2、A_6、A_5	Social governance environment for cross-border e-commerce development of manufacturing industry

According to Table 3, Table 4, and Table 5 above, the common factor score of each province is calculated through the application of the regression method, and the final comprehensive score of the CB-EC development environment of the manufacturing industry in each province is calculated according to the weight of common factor. The results are shown in Table 6 below:

Table 6 score and ranking of cross-border e-commerce factors of the manufacturing industry in 30 provinces in 2020

Province	Comprehensive score	Comprehensive score ranking	F1 score	F1 Score ranking	F2 score	F2 Score ranking	F3 score	F3 Score ranking
Beijing	0.290	6	0.227	23	0.737	1	-0.231	17
Tianjin	0.103	15	0.101	30	0.224	3	-0.086	6
Hebei	0.118	14	0.393	9	-0.182	26	-0.277	20
Shanxi	0.043	23	0.238	21	-0.127	17	-0.308	21
Inner Mongolia	0.050	22	0.228	22	-0.112	15	-0.257	19
Liaoning	0.131	13	0.259	17	0.022	6	-0.105	9
Jilin	0.040	24	0.195	27	-0.049	10	-0.314	22
Heilongjiang	0.060	21	0.252	18	-0.014	9	-0.437	28
Shanghai	0.319	4	0.245	19	0.737	2	-0.120	10
Jiangsu	0.468	2	0.952	2	-0.086	14	-0.186	14
Zhejiang	0.392	3	0.708	3	0.111	5	-0.166	13
Anhui	0.147	12	0.388	10	-0.180	25	-0.098	8
Fujian	0.208	7	0.419	6	-0.049	11	-0.051	3
Jiangxi	0.094	18	0.318	12	-0.162	23	-0.211	16
Shandong	0.312	5	0.678	4	-0.144	20	-0.127	11
Henan	0.187	8	0.451	5	-0.242	30	0.035	1
Hubei	0.159	10	0.365	11	-0.140	18	-0.017	2
Hunan	0.152	11	0.395	8	-0.196	29	-0.066	5
Guangdong	0.651	1	1.216	1	0.193	4	-0.416	27
Guangxi	0.073	19	0.275	14	-0.159	22	-0.200	15
Hainan	0.009	26	0.132	29	0.006	8	-0.383	24
Chongqing	0.099	16	0.204	26	0.011	7	-0.095	7
Sichuan	0.177	9	0.417	7	-0.155	21	-0.053	4
Guizhou	0.024	25	0.239	20	-0.192	28	-0.318	23
Yunnan	0.070	20	0.264	15	-0.119	16	-0.246	18
Shanxi	0.097	17	0.263	16	-0.084	13	-0.140	12
Gansu	-0.015	28	0.215	25	-0.183	27	-0.483	29
Qinghai	-0.044	30	0.311	13	-0.051	12	-1.170	30
Ningxia	-0.030	29	0.146	28	-0.142	19	-0.415	26
Xinjiang	0.004	27	0.217	24	-0.174	24	-0.391	25

According to Table 6, there are significant differences in the development environment of manufacturing CB-EC in the 30 provinces where China has set up comprehensive CB-EC pilot zones. From the total score, the top five provinces are concentrated in the eastern coastal areas and are also the

provinces with a relatively concentrated distribution of China's manufacturing industry. The ranking of 6-10 is mainly concentrated in the north, the Middle East, and the southwest and northwest provinces, and the comprehensive score ranking is relatively low. The total score of Guangdong Province, ranking No. 1, is 0.651, and the total score of Jiangsu Province, ranking No. 2, is 0.468. The difference is 0.183. This situation also reflects that China's manufacturing industry's overall level of CB-EC development environment is not high. There is still a lot of room for development.

V. Conclusion and Prospect

Through this study, it is found that, on the whole, the operation mode of CB-EC in China's manufacturing industry has gradually changed from the operation mode dominated by agents to the independent operation of manufacturing business entities. The development mode also shows various development trends, the policy environment has been continuously optimized, and there is a broad market potential simultaneously. On the whole, CB-EC in China's manufacturing industry will still usher in a stage of rapid development in the future. However, through the comprehensive evaluation of the development environment of manufacturing CB-EC in 30 provinces where China has set up comprehensive pilot zones of CB-EC, the gap between the eastern, central, and western provinces of China is very significant. The Chinese government strengthens the infrastructure construction in the central and western regions and more precise policy investment and strengthens the support of various production factors. The Chinese government will help improve the CB-EC development environment of the manufacturing industry in this region to improve the development level of CB-EC in China's overall manufacturing industry.

This study focuses on the macro perspective in the quantitative analysis process. In the follow-up study, we will conduct micro-level interviews and questionnaires in regions with relatively high comprehensive scores for the development environment of CB-EC in China's manufacturing industry. We will further analyze the factors affecting the development of CB-EC in China's manufacturing sector and obtain more in-depth and comprehensive research results.

Acknowledgment

This work was supported by a Research Grant from Pukyong National University (2021).

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