Research on the International Competitiveness of Digital Service Trade between China and RCEP Member Countries —based on Porter's Diamond Model

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Abstract. Currently, digital service trade has gradually become an important driving force for national economic development. Studying the international competitiveness of digital service trade between China and other RCEP member states will provide suggestions for China to optimize its corresponding trade export construction in the future. This can also promote the improvement of the international status of digital service trade among RCEP member countries. The article is based on Porter's diamond model and uses factor analysis to study the international competitiveness of digital service trade in RCEP member states. Research results show that China ranks in the middle among RCEP members, the competitiveness still slightly behind other major Asian countries. At the same time, it can be seen that the main factors that affect competitiveness are diverse, and the most important is factor conditions. To enhance competitiveness in digital service trade, RCEP member countries should prioritize infrastructure development, talent cultivation, regional cooperation, and seeking new partnerships.

Keywords: Digital service trade, RCEP member countries, Porter's diamond model

1 INTRODUCTION

In the 21st century, the development of the internet and mobile communication technology has laid the foundation for the globalization of digital service. Data elements have broken down the barriers between non-trade and service trade, ushering in a new era of service trade [1]. Digital service trade strengthens international business relations and offers innovative solutions to environmental and social challenges. Therefore, it is considered a new engine for national economic development.

The distribution of digital service trade is uneven globally, with a small number of developed countries dominating digital service exports [2]. The growth of digital service trade not only on individual efforts of countries but also on cooperation and promotion among them. The Regional Comprehensive Economic Partnership (RCEP) agreement, signed by major Asian economies, highlights their strong desire to enhance

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economic integration and achieve collective progress [3]. RCEP facilitates information sharing, technological innovation, and coordination of trade rules, creating new digital service trade opportunities among its members.

Current scholarly research on RCEP's digital service trade focuses mainly on its competitiveness, complementarity, and export potential. By calculating the Trade Complementarity Index (TC), Comprehensive Trade Complementarity Index, and Revealed Comparative Advantage (RCA), scholars have found significant differences in the competitiveness of different industries involved in digital service trade between China and RCEP member states, with a general lack of complementarity [4,5]. Some researchers have used stochastic frontier models or stochastic frontier gravity models to analyze China's export efficiency and potential to RCEP member countries in the digital services sector [6,7]. The studies reveal that there is still considerable room for improvement in China's digital services export efficiency to RCEP member countries, which can be addressed through upgrading agreement levels and strengthening trade relations [6,7]. This article utilizes Porter's Diamond Model and factor analysis to investigate the international competitiveness of digital service trade in RCEP member states. The report compares China's competitiveness rankings with other RCEP members and suggests ways to improve digital service trade competitiveness.

2 OVERVIEW OF DIGITAL SERVICE TRADE AMONG RCEP MEMBER COUNTRIES

Trade organizations and countries have varying views on the statistical quality of digital service trade. Currently, the statistical caliber of the United Nations Conference on Trade and Development (UNCTAD) is the most widely used. This method is referenced in the "Digital Trade Development White Paper 2020" by the China Academy of Information and Communications Technology and in the "North American Digital Trade Report" by the U.S. Department of Commerce. Therefore, the article chooses UNCTAD's statistical caliber. According to the UNCTAD report, digital trade in services can be classified into six categories: insurance services, financial services, intellectual property services, ICT services, other business services, and personal and recreational services [8]. To represent the scale of digital service trade in RCEP member states, calculate the total export volume of the six categories included in the "Balance of Payments and International Investment Position Manual, Sixth Edition" (BPM6) of the service industry in the UNCTAD database.

According to Figure 1, the total digital service trade exports of RCEP member countries have consistently grown from 2018 to 2022, rising from US$475.213 billion to US$650.610 billion [8]. China's digital service trade exports also experienced year-by-year growth within this period. Both RCEP member countries and China have maintained positive growth in their digital service trade exports over the past five years. However, between 2021 and 2022, the growth rate has slowed down sharply [8]. This could be attributed to the global economic tension caused by the COVID-19 pandemic in 2020. Nevertheless, the Asia-Pacific region plays a crucial role in global trade [9]. After the global economic recovery in 2021, offline international trade exchanges

returned to normal levels. In this state, digital service trade has been weakened by the stimulus of the epidemic, showing a slowdown in trade growth. China's proportion of digital service trade exports among RCEP member countries has shown a slight increase, from 27.81% in 2018 to 32.11% in 2022.

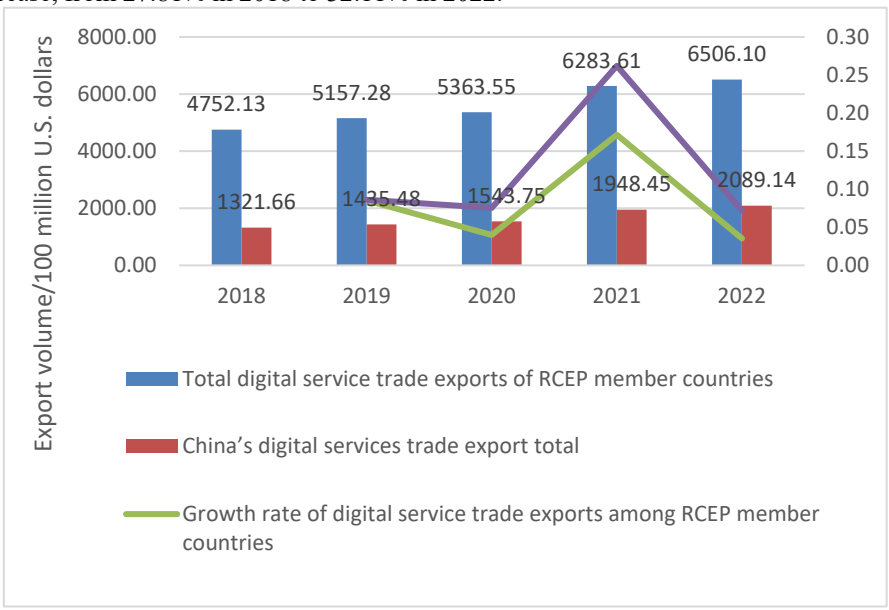

Fig. 1. Export Volume and Growth Rate of Digital Service Trade between RCEP Member Countries and China from 2018 to 2022 (original).

3 CONSTRUCTION OF EVALUATION INDICATORS FOR THE INTERNATIONAL COMPETITIVENESS IN DIGITAL SERVICE TRADE AMONG RCEP COUNTRIES

Michael Porter developed a diamond model comprising four key elements: production factors, demand factors, related industry support, and corporate organization, strategy, and competition [10]. He identified government and opportunity as two variables that also influence national competitiveness [10]. This article discusses Zhang H Y et al.'s method for analyzing China's competitiveness in digital service trade [11]. Based on Porter's Diamond Model and the unique features of digital service trade, the article proposes an evaluation system for analyzing the international competitiveness of digital service trade within the RCEP member states. The system includes 11 selected data indicators, which are elaborated in Table 1.

Under factor conditions, the availability of skilled human resources and reliable Internet infrastructure is crucial. To measure the quality of human resources, this article uses the Global Innovation Index (X_1) and the Human Capital Index (X_2). Additionally,

individuals using the internet (X_3) and Fixed broadband subscriptions (X_4) are selected as indicators to assess the strength of a country's internet infrastructure.

The second is demand conditions, which stresses the significance of local consumer demand in boosting industrial competitiveness. To assess the level of demand within a country, indicators such as GDP per capita (X_5) and the number of imports of digital services (X_6) are employed.

The third is related industry and supporting industries. A robust and stable industrial supply chain can drive high-quality industry growth. To measure the support received by these industries, the article uses the export volume of digital service trades (X_7) and the e-commerce development index (X_8).

The fourth factor is Firm Strategy, Structure, and Rivalry. Variations in enterprise production efficiency due to cultural differences among countries impact each country's industrial competitiveness. To reflect the market structure and competition, this article considers the percentage of FDI in GDP as an indicator (X_9).

The fifth factor is government. A favorable business environment significantly enhances the competitiveness of the digital service trade. Government policies play a crucial role in creating such an environment. The political stability index is used in this article as a measurement indicator (X_{10}).

The sixth factor is chance. Changes in economic globalization have a significant impact on the development of digital service trade. To measure this influence, the article adopts the economic globalization index (X_{11}) as an indicator.

Table 1. Index System for International Competitiveness of Digital Service Trade

Primary Indicators	Code	Secondary Indicators
Factor Conditions	X_1	Global Innovation Index, GII
	X_2	Human capital index (HCI) (scale 0-1)
	X_3	Individuals using the Internet (% of the population)
	X_4	Fixed broadband subscriptions (per 100 people)
Demand Conditions	X_5	GDP per capita
	X_6	Digital service trade import volume
Related and Supporting Industries	X_7	Digital service trade export volume
	X_8	e-commerce development index
Firm Strategy, Structure, and Rivalry	X_9	Foreign direct investment, net inflows (% of GDP)
Government	X_{10}	Political Stability and Absence of Violence/Terrorism: Percentile Rank
Chance	X_{11}	Economic Globalization Index

4 EMPIRICAL ANALYSIS

4.1 Analysis Method

This study utilized data from various sources including the World Intellectual Property Organization, World Bank, UNCTAD, and International Statistical Yearbook, spanning from 2018 to 2022. All data were calculated on an annual basis. Longitudinal data were used for the specified years, while cross-sectional data were used for 2022. Missing data were replaced by the average of available data. Factor analysis was conducted using SPSS 20.0 software, followed by principal component analysis after passing KMO and Bartley's test. Rotated principal components were then used to calculate factor scores and rank the international competitiveness of digital service trade within RCEP member states.

4.2 Factor Analysis Results

This paper extracts three main factors after applying the above analysis method. The composite factor score is calculated based on the following formula.

$$F = 0.663F_1 + 0.190F_2 + 0.147F_3 \quad (1)$$

The detailed results are shown in Table 2. Observing the factor scores, it can be noted that both F_1 and F_3 exhibit an upward fluctuating trend, reaching their highest values in 2022 at 1.023 and 1.151, respectively. The F_2 score shows significant fluctuations, ranging from 2.49574. Although there is instability in the year-to-year changes for each factor, the comprehensive factor score consistently increases over time. Specifically, the comprehensive factor score rises from -0.942 in 2018 to 0.789 in 2022, indicating China's digital service trade is continuously improving its international competitiveness.

Table 2. International Competitiveness of China's Digital Service Trade from 2018 to 2022

	F_1Factor Score	F_2Factor Score	F_3Factor Score	Comprehensive Factor Score
2018	-0.903	-1.467	-0.435	-0.942
2019	-1.079	0.831	0.964	-0.415
2020	-0.028	1.029	-1.111	0.014
2021	0.987	-0.091	-0.569	0.553
2022	1.023	-0.302	1.151	0.789

4.3 Comprehensive score calculation and analysis

Principal component analysis was performed on 2022 data for indicators of RCEP member countries. Table 3 demonstrates a cumulative variance contribution rate of 89.802% when extracting three factors, making this choice suitable for the study.

Table 3. Total Variance Explained

Component	Initial Eigenvalues			Extract Sums of Squared Loadings			Rotational Sum of Squares Loadings		
	Total	% of variance	Cumulative%	Total	% of variance	Cumulative%	Total	% of variance	Cumulative%
1	6.577	59.793	59.793	6.577	59.793	59.793	5.412	49.202	49.202
2	2.030	18.452	78.245	2.030	18.452	78.245	2.786	25.331	74.533
3	1.271	11.557	89.802	1.271	11.557	89.802	1.680	15.269	89.802

The factors in this article are named based on Table 4. Public factor 2 is named the trade factor because it has large loadings on X_6 (Digital service trade import volume) and X_7 (Digital service trade export volume). Public factor 3 is named the foreign investment factor as it demonstrates a substantial loading on X_9(Foreign direct investment, net inflows). The absolute values of the remaining index coefficients are larger on the common factor 1, which are named basic factors.

Table 4. Rotated Component Matrix

Code	1	2	3
X_8	0.953	0.204	0.064
X_3	0.936	0.000	0.048
X_2	0.887	0.339	0.171
X_5	0.800	0.217	0.386
X_{10}	0.774	-0.060	0.326
X_4	0.762	0.547	-0.096
X_1	0.734	0.596	0.017
X_{11}	0.674	-0.111	0.674
X_7	0.063	0.971	0.151
X_6	0.147	0.954	0.102
X_9	0.068	0.245	0.945

The scores for the three factors can be calculated using the factor score coefficient matrix, with the factor variance contribution rate after orthogonal rotation serving as the weights. The comprehensive score and ranking are determined by the formula.

$$F = 0.6658F_1 + 0.2055F_2 + 0.1287F_3 \quad (2)$$

According to the calculated comprehensive score ranking, the international competitiveness of digital service trade of RCEP member countries is ranked. As shown in Table 5, China's digital service trade competitiveness ranks 8th among RCEP member countries, positioning it in the middle. The top three countries in terms of competitiveness are Singapore, South Korea, and Japan.

In the F_1 score ranking, which encompasses various indicators such as production factors, government, and opportunities, the leading countries are New Zealand, Australia, and South Korea. This indicates that factor conditions, stable markets, and government policies supporting digital service trade greatly enhance competitiveness. However, China ranks 10th in this factor score, potentially due to a later start in

digitalization compared to developed countries. Nevertheless, the year-over-year increase in China's F_1 factor score from 2018 to 2022 demonstrates its increasing focus on digital services.

In the F_2 score ranking, the top three scores are China, Singapore and Japan. This factor includes two indicators: import and export volumes of digital service trade. Therefore, countries with greater import and export demand are ranked high here. The huge trade volume provides high-quality markets for all countries. Not only that, it also provides impetus for the development of the industry. In the F_3 score ranking, Singapore, Cambodia, and Malaysia hold the top positions. These countries, being important economies in Southeast Asia with advantageous geographical locations, serve as crucial hubs connecting Asia and other regions, making them attractive for foreign investment. China ranks 15th in this factor, facing a disadvantage compared to these countries.

Table 5. Score and Comprehensive Evaluation of International Competitiveness Factors in Digital Service Trade among RCEP Member Countries

Country	F_1 Factor		F_2 Factor		F_3 Factor		Comprehensive Factor	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Singapore	0.710	5	1.350	2	3.049	1	1.142	1
Korea	1.168	3	0.429	4	-0.925	14	0.747	2
Japan	0.817	4	1.172	3	-0.399	13	0.733	3
Australia	1.241	2	-0.406	8	-0.119	6	0.728	4
New Zealand	1.287	1	-0.692	12	-0.226	8	0.686	5
Brunei	0.635	6	-1.269	15	-0.199	7	0.136	6
Malaysia	0.375	7	-0.789	13	0.106	3	0.101	7
China	-0.406	10	2.486	1	-1.193	15	0.087	8
Thailand	0.058	8	-0.463	10	-0.349	11	-0.102	9
Viet Nam	-0.023	9	-0.569	11	-0.303	10	-0.171	10
Indonesia	-0.775	11	-0.429	9	-0.373	12	-0.652	11
Lao	-0.993	12	-0.006	6	-0.046	4	-0.668	12
Philippines	-1.032	13	-0.231	7	-0.102	5	-0.748	13
Cambodia	-1.203	14	-0.848	14	1.315	2	-0.806	14
Myanmar	-1.859	15	0.266	5	-0.236	9	-1.213	15

5 SUGGESTIONS

5.1 Prioritize digital infrastructure development and the cultivation of high-tech talents

According to the analysis, the top three countries with the highest F_1 factor scores are all developed economies, which have an early advantage in the high-tech services field. Notably, production factors account for a significant proportion. Therefore, for RCEP

member countries, enhancing the quality of production factors in the digital service trade is of utmost importance.

Digital infrastructure and a skilled workforce are the key components of production factors in the digital service trade. Countries should prioritize improving network connectivity speed and stability, as well as promoting the development of emerging technologies such as 5G to ensure smooth data flow. Both the government and private sector should increase investment in infrastructure, including expanding fiber optic network coverage, constructing data centers, and developing cloud computing infrastructure. Moreover, countries need to strengthen collaboration among educational and training institutions to foster professional talents and technical personnel. To meet the talent demand in the digital service trade, the education and training system must keep up with the latest trends. Higher education institutions should update their courses, incorporate content related to the digital service trade, and cultivate students' technical capabilities and innovative spirit.

5.2 Strengthen regional cooperation and exchanges among RCEP member countries

According to the analysis, the top three countries with high F_2 factor scores heavily rely on foreign trade. China, ranking first in scores, is the world's largest exporter and second-largest importer. Its significant import and export volume in digital service trade reflects its strong international competitiveness. This is a result of China's compliance with economic globalization, continuous openness to the world, and active economic cooperation based on equality and mutual benefit. Such an approach greatly enhances the competitiveness of the digital service trade. Therefore, RCEP member countries should strengthen regional cooperation, share experiences, and explore joint solutions to challenges in the digital service trade. Collaborative platforms and mechanisms play a critical role in enabling information sharing, technological innovation, and enhancing digital service trade competitiveness. To promote growth in this sector, it is essential to prioritize international cooperation and establish appropriate legal frameworks.

5.3 Actively seek and expand new partners for RCEP

Based on the F_3 factor analysis, the FDI improves digital service trade competitiveness. The use of foreign investment can expand industrial scale and promote innovation. Therefore, it is very necessary to use regional economic cooperation to promote FDI utilization. RCEP member countries should actively seek new markets and trading partners and promote the diversification and internationalization of digital service trade. Cooperation with other regions can also be strengthened to explore broader market opportunities.

6 CONCLUSION

Digital service makes it possible to deliver services quickly and efficiently, which fosters innovation and brings dynamism into the global economy. By analyzing the competitiveness of digital service trade, governments can identify strengths and weaknesses to promote high-quality industry development. The recently signed RCEP has prompted major Asian economies to adopt economic integration measures. This can also improve its international competitiveness in economy, trade, and other aspects. It provides new opportunities for RCEP member states to improve their competitiveness in the digital service trade.

To measure the competitiveness of digital service trade among RCEP member countries, this article uses digital service trade data from 2018 to 2022 and constructs an evaluation index based on Porter's "Diamond Model". It conducts factor analysis using SPSS20.0 on the collected data and extracts three principal components. After rotation, three common factors are identified, named, and scored to determine rankings.

The results indicate that among RCEP member countries, China ranks in the middle position in terms of international competitiveness in digital service trade. Although there has been some improvement in this field, China is still falling behind other significant Asian countries. Various factors affect the competitiveness of digital service trade, with basic factors having the greatest impact on improving competitiveness. The factor indication is the most influential among basic factors. In the future, RCEP member states should exchange experiences in digital infrastructure and high-tech cultivation while promoting bilateral trade cooperation. To enhance competitiveness, RCEP member states also should strengthen regional cooperation and actively seek new partners while expanding the scope of RCEP.

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