Comparative Study of Digital Economy Development Level in Seven Asian Countries

ABSTRACT

The digital economy, which uses digital knowledge and information as key production factors, modern information networks as an important carrier, and effective use of information and communication technologies as an important driving force for efficiency improvement and economic structure optimization, has led the way as a new economic form after the Internet age.

Therefore, this paper conducts a comparative study on the digital economy development level of seven Asian countries: China, Japan, Korea, Singapore, India, Indonesia, and Malaysia. This paper presents a proposed evaluation index system of digital economy. The seven countries are calculated to get the digital economy development index from 2014 to 2016. Then quantitative analysis, mathematical analysis, comparative analysis and DEA method are used to analyze the digital economy development of China and other six countries. Pearson correlation analysis and curve fitting by MATLAB are performed on relevant indicators of digital technology and economy development, trying to explore the influencing factors of digital economy. Finally, on this basis, policy suggestions to improve China's digital economy development level are putted forward.

KEY WORDS: Digital Economy; Indicator System; Seven Asia Countries; Comparative Analysis

EXECUTIVE SUMMARY

With the rapid development of evolving digital technologies such as Big data, Cloud computing, Artificial Intelligence, and the Internet of Things, the application of the Internet has infiltrated all social production activities. The traditional real economy has gradually turned to digital. The digital economy, which uses digital knowledge and information as key production factors, modern information networks as an important carrier, and effective use of information and communication technologies as an important driving force for efficiency improvement and economic structure optimization, has led the way as a new economic form after the Internet age. Therefore, this paper follows this development trend, understands the concept of digital economy, and conducts a comparative study on the digital economy development level of seven Asian countries: China, Japan, Korea, Singapore, India, Indonesia, and Malaysia., calculates the China's digital economy development level in Asia, and puts forward constructive policies and recommendations based on the analysis results.

This paper elaborates current understandings of digital economy in various countries around the world, and presents a proposed evaluation index system of digital economy. The data are standardized by average method, and the weight coefficient of each index is assigned by variation coefficient method. The seven countries are calculated to get the digital economic development index from 2014 to 2016. Then quantitative analysis, qualitative analysis, mathematical statistics, comparative analysis and Data Envelopment Analysis are used to analyze the digital economy development of China and other six countries. Finally, on this basis, Pearson correlation analysis and curve fitting are performed on relevant indicators of digital technology and economic development, trying to explore the influencing factors of digital economy.

At the end, based on the research, this paper puts forward policy suggestions on the infrastructure improvement, development of talent education and training, investment in evolving digital technologies, and deepening domestic and international cooperation to promote the export of ICT services. These suggestions will help accelerate the digital transformation of China and improve digital economy development level in China.

1. Introduction

1.1 Research Background

With the maturity and application of emerging digital technologies such as Big Data, Mobility, the Cloud, Artificial Intelligence, and IoT, digital technology has merged with human production and life, and has produced tremendous economic development and people's lives. influences. The traditional real economy has gradually turned to digital. The new digital economy models such as Internet shopping, mobile payment, and shared economy are booming in the world.

At present, the vigorous development of digital economy has caused widespread concern. Many countries in the world regard the development of digital economy as an important kinetic energy for achieving innovation and development. In 2016, the "2016 China Information Economy Development Report" released by the "China Informatization Hundred People's Association"[1] shows that the total digital economy in the United States has reached 11 trillion US dollars in 2016, accounting for 59.2% of GDP; Japan and The UK's total digital economy reached $2.3 trillion and $1.43 trillion, accounting for 45.9% and 54.5% of its GDP.

Digital economy can inject new vitality into different economies, thereby promoting a wider range of emerging formats, providing faster digital information flows and more convenient emerging digital technologies. Therefore, how to use the continuous innovation and application of emerging technologies such as Big Data, Mobility, the Cloud, Artificial Intelligence, and IoT to enjoy the dividends brought about by the development of digital economy is a major opportunity and challenge in the era of digital economy.

1.2 Relevant of Research

This paper performs researches on the measurement of digital economy level of seven Asian countries with the assessment indicator scheme as appropriate, illustrating a comprehensive picture of each country to better understand China’s digital economy level.

Mathematics statistical methodologies are used in comparative analysis of digital economy to determine whether the gap is existed between the digital economy development level of China and the other six countries; in the meantime, Pearson correlation analysis and curve fitting are performed on relevant indicators of digital technology and economic development, trying to explore the influencing factors of digital economy.

Based on such data, conclusions are drawn and studies are made to explore ways to improve the digital economy development level of China. These can be leveraged to some extent to guide China's informatization drive while facilitating the identification of China competitive edge in Asian and therefore could be valuable references to the design of national development strategies and competition policies.

2 Review of Researches

2.1 The Concept of Digital Economy

In 2016, China, as the chairman of the G20[2], listed the "digital economy" as an important issue in the G20 innovation growth blueprint for the first time. "Digital economy refers to a series of economic activities that use digital knowledge and information as key production factors, modern information networks as an important carrier, and the effective use of information and communication technologies as an important driving force for efficiency improvement and economic structure optimization." This definition that attributes the digital economy to an economic activity is the integration of the Internet, the information and communication industry, and other traditional industries.

OECD, the Organization for Economic Co-operation and Development focuses on measuring the digital economy, which defines the digital economy as: "trade in goods and services through e-commerce[3]."

In conclusion, the digital economy is based on the information and communication industry including the Internet. Therefore, this paper measures digital economy based on the G20 definition of it, mainly measures from digital knowledge and information, modern information networks, information and communication technologies, and economic activities using digital technologies.

2.2 Research on Digital Economy Evaluation Index System

2.2.1 Researches outside China

In recent years, the digital economy, as the main driving force for the integration and innovation of traditional industries and emerging information technologies, has gradually become the main development trend of the global future economy. Some well-known international organizations have gradually begun to participate in the research on the evaluation of digital economic development, and successively The digital economic evaluation index and

evaluation report were launched. In this section, this paper will introduce the digital economy evaluation index system to provide some reference suggestions for the research.

1.NRI

The World Economic Forum (WEF)[4] released "Innovating in the Digital Economy" report in 2016 and measured Digital Economy by the Networked Readiness Index (NRI), which analyzed from the four aspects: information environment, information preparation, information application and informationization. NRI calculates the information index by weighting to measure the development level of informationization and analyze the development of digital economy.

2. DESI

The European Union's Digital Economy and Society Index (DESI)[5] is a composite index that summarizes about 30 relevant indicators of European digital performance including human capital, Internet use, and digital. It tracks the development of EU member states to measure the transition of EU countries to the digital economy.

3. UNCTAD

The United Nations Conference on Trade and Development (UNCTAD)[6] released the 2017 Information Economy Report on the theme of “Digitalization, Trade and Development” in 2017, in which UNCTAD proposed: “Digital The economy is just getting started, but it has and will continue to have a transformative impact on the way we live, work and economically on a global scale.” To measure the digital economy, UNCTAD made statistics and analysis on the development of digital economy in some countries around the world from the five perspectives of enterprises and individuals' access and use of ICT, ICT sectors and industries, e-commerce development, trade in digital economy and emerging elements of digital economy.

4. OECD

The Organization for Economic Cooperation and Development (OECD)[7] released the OECD Digital Economy Outlook 2017 report and measured Digital Economy by the Digital Economic Index (DEI), which analyzed from the four aspects: digital transformation conditions, digital infrastructure, commercial applications of digital technologies, Internet users use digital technology, digital skills, ICT-related innovation, digital security and trust.

2.2.2 Researches in China

1. Huawei GCI

In the “Release of Connections”[8] report released by Huawei in 2017, Huawei uses the Global Connectivity Index (GCI) to look at the transformation and future of the national

economy from the perspective of connectivity, focusing on exploring innovative ICT technologies. It uses 34 indicators to measure the digital economic level of a country around four factors, including supply, demand, experience and potential, as well as five major enabling technologies: broadband, data center, cloud computing, big data and Internet of things.

2. China Academy of Information and Communications Technology

In July 2017, CAICT[9] released the White Paper on China's Digital Economy Development. In the white paper, the DEI Index (Digital Economy Index) was proposed to comprehensively reflect the current trajectory of China's digital economy.

Comparing the above researches by organizations and scholars inside and outside China, it can be concluded that existing Digital Economy assessment schemes in China do not have a complete set of indicators so the measurement cannot accurately incorporate all factors in each aspect.

3. Design of the Evaluation Index System for the Digital Economy of Seven Asian Countries

3.1 Construction of Digital Economic Evaluation Index System

3.1.1 Selection of Indicators

This paper selects indicators from five angles: basic ability, skill training, integration application, capital security and macroeconomics.

1）In terms of basic ability, this paper measures the level of digital technology and infrastructure which determines the development of the digital economy. The indicators include: “the number of fixed broadband users per hundred people”, “the number of mobile broadband Internet users per hundred people”, and “the average connection speed of broadband”; The indicator data is derived from UNCTAD and Akamai respectively. Akamai is a CDN service provider born in MIT whose servers are distributed in more than 90 countries around the world, therefore, it can monitor the Internet status in real time and count web connection speed and web traffic congestion. This paper uses the "Average Connection Speed" from Akamai's "Quarterly Connectivity Reports". The data for each year is the average of four quarters to measure the country's network connection rate.

2) In terms of skill training, this paper measures the education level of the overall residents

and high-tech ICT talents which reflect the human resources situation in the development of digital economy. The indicators include: “Gross enrollment rate of higher education”, “average years of education”, “number of IT staff”, “number of software developers”. The indicator data is derived from UNCTAD and Huawei’s GCI index respectively.

3) In terms of application integration, this paper measures typical business that relies on digital technology for industry updates and transforms and applications for digital technologies. The indicators include: “ICT service exports”, “number of e-commerce (online) transaction”, “number of application downloads”. The indicator data is derived from Huawei’s GCI index and Word Bank respectively. Word Bank (World Bank) has a database that provides free development data of countries around the world. The data sources are authoritative and scientific.

4) Capital security is used to measure the capital and resource factors which guarantee the development of the digital economy. Appropriate investment is crucial for the development of emerging digital technologies. Indicators include: “big data investment”, “cloud service investment”, “investment of internet of things”, “cloud rate”, “generation of big data” and “the total number of Internet of Things devices”; the indicator data are all derived from Huawei's GCI index.

5) In terms of macroeconomics, this paper reflects the macro background of the development of the digital economy at macroscopic angle. The indicators include: “per capita GDP” and “percentage of final consumption expenditure”; the indicator data derived from Word Bank.

Referring to the framework structure of the DESI and DEI indicator systems in Chapter 2, this paper takes the economic meaning of the indicators, the representativeness of the indicators, especially the availability of data into account, and puts forward Digital Economy Level Index (DELI) including five the first-level indicators, ten second-level indicators, and eighteen third-level indicators based on the researches above.

3.1.2 Data Sources and Standardized Treatment

The data used in the three-level indicators of this paper mainly comes from Word Bank's Data Bank, UNCTAD's "Information Economy Report 2017: Digitization, Trade and Development", and Huawei's "Release the Linkage - Global Linkage Index 2017 Quantification The Digital Economy Process report and Akamai's Quarterly Connectivity Reports report.

The evaluation results may be difference for the selected indicators may have different

dimensions and different orders of magnitude[10]. Therefore, all the three-level indicator data need to be unified and standardized. Considering that there is no negative indicator in the indicator system, the data is normalized by the average method[11].

3.1.3 Weight Determination of Indexes

Table 3-1 Composition and weights of DELI

First-Class indexes	Weight	Second-Class indexes	Third-Class indexes	Weight
Digital Infrastructure	0.206	Network Access Level	Fixed broadband subscribers per 100 people	0.0757
			Number of mobile broadband Internet users per 100 people	0.0536
		Network Connection Rate	Broadband average connection speed	0.0764
Digital Skills Training	0.210	Resident Cultural Diathesis	Gross enrolment ratio of higher education	0.0525
			Average years of schooling	0.0247
		ICT Talents	Number of IT practitioners	0.0686
			Number of software developers	0.0646
Digital Technology Use	0.169	Digital Service Export	ICT service export	0.0400
		Digital Application	E-commerce (online) transaction volume	0.0750
			App downloads	0.0541
Digital Technology Capital	0.309	Digital Technology Investment	Investing in Big Data	0.0537
			Investing in the Cloud	00479
			Investing in the IoT	0.0464
		Digital Technology Resources	The Cloud usage	0.0363
			Big Data generation	0.0768
			Total amount of the IoT	0.0477
Economic Development	0.106	Economic Development Level	GDP Per Capita	0.0911
		Consumption Ability	Final consumption expenditure percentage	0.0150

The rationality of the determination of index weight plays a decisive role in the accuracy of the whole evaluation index system. The weighting method can be divided into subjective weighting method and objective weighting method. In order to reflect the level of China's informatization development more objectively, the objective weighting method will be adopted

in the digital economic evaluation index system of this paper. It based on the mathematical statistics method, and take the statistical nature of the indicators into consideration. Combining various objective weighting methods, this paper will adopt the coefficient of variation method to assign weights. The basic idea of the coefficient of variation method is that if an indicator has a large degree of variation in the observations of all evaluation indicators, the indicator should be given a larger weight. Therefore, this paper uses the coefficient of variation method to determine the weight of each of the three indicators in the digital economic development level index. The composition and weights of DELI are shown in Table 3-1.

3.2 Calculation of the level of digital economic development

The Linear Weighting Method is adopted to calculate the indexes in this paper[12]. According to the calculation, the results of Digital Economy Level Index (DELI) of the seven countries from 2014 to 2016 are shown in Table 3-2.

Table 3-2 DELI of seven countries (2014 to 2016)

	Digital Economy Level Index		
	Year 2014	Year 2015	Year 2016
China	0.6026	0.6450	0.7093
India	0.4105	0.4558	0.5040
Indonesia	0.4365	0.4674	0.5082
Japan	1.4528	1.4421	1.5705
South Korea	1.4476	1.4608	1.5722
Malaysia	0.7062	0.8067	0.8121
Singapore	1.6067	1.6162	1.7670

4. Comparison of DELI of Seven Asian Countries

4.1 General Overview

As shown in Figure 4-1, there is a certain gap between the index values of the seven countries, which is particularly clearly divided into three phases:

1) The index value is higher than 1.0, which can be defined as the front runners, including Singapore, Japan, and Korea;

2) The index value is between 0.6 and 1.0, which can be defined as the pursuers, including China and Malaysia;

3) Index values below 0.6 can be defined as the beginners, including India and Indonesia.

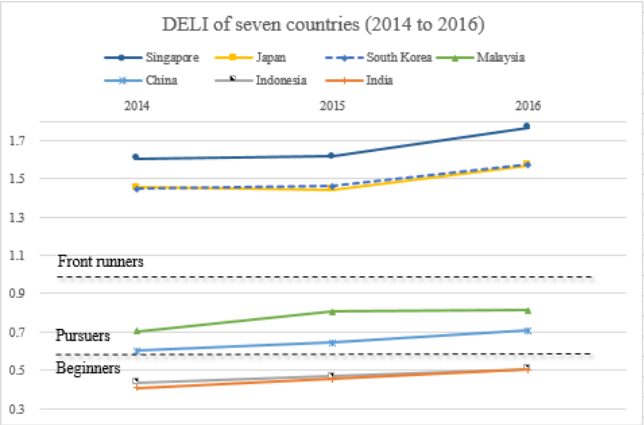

Figure 4-1 DELI of seven countries (2014 to 2016)

From an incremental perspective, as shown in Figure 4-2, the black cylinder represents the country whose DELI increase is higher than the average, and the gray cylinder indicates that the country whose DELI increase is less than the average. From 2014 to 2016, DELI of Singapore, as a front runner, is the fastest growing, surpassing the average increase of the seven countries. South Korea and Japan follows closely. DELI of China and Malaysia, as the pursuers, is slightly lower than the average, and the development speed is slightly faster. India and Indonesia as the beginners, although Indonesia's DELI is slightly higher than India, but India's DELI increase is much higher than Indonesia, and its DELI may overtake Indonesia's in the future.

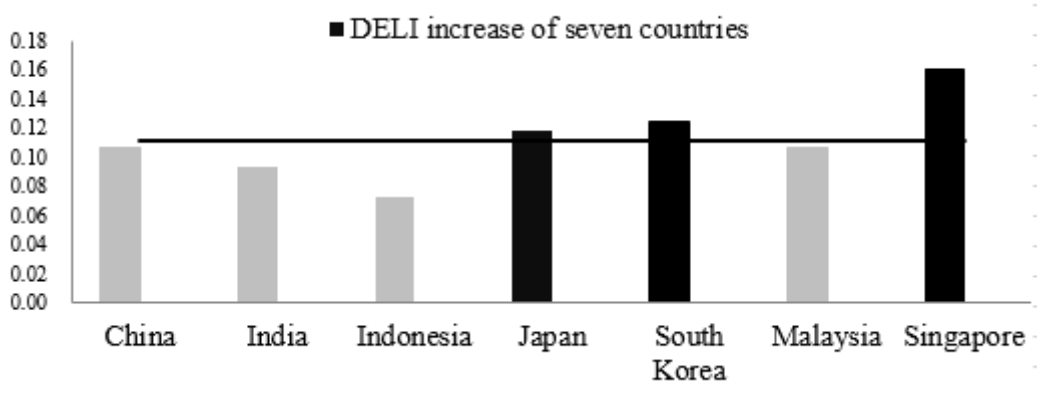

Figure 4-2 DELI increase of seven countries

As shown in figure 4-3, Singapore, Japan and South Korea have relatively balanced performance in each level of indicators, all above the average level. In particular, Singapore has a high level of national economic development and South Korea has a good digital infrastructure construction. Malaysia performs better on two indicators, "digital skills training" and "digital infrastructure construction", which are very close to the average level, while China has more advantages in "digital technology capital" and "digital technology integration". In

India and Indonesia, the performance of the five first-level indicators is not as good as the other four countries.

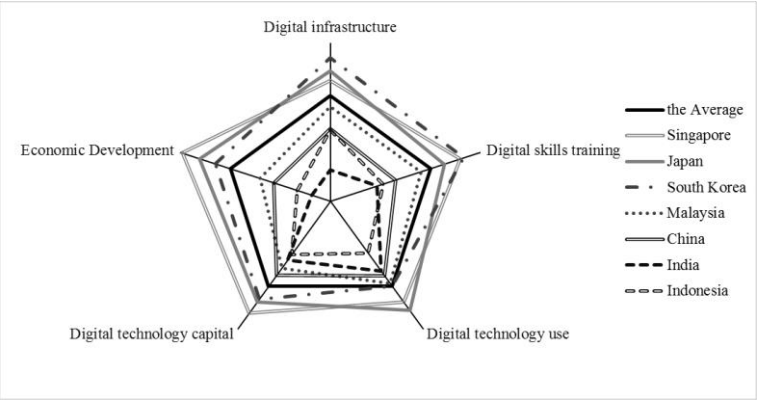

Figure 4-3 First-class indexes radar chart of seven countries

The following paper will analyze and compare the front runners, pursuers and beginners from their performances of first-class indexes, second-class indexes and third-class indexes.

4.2 Front Runners' DELI Comparison

As shown in Figure 4-4, Singapore has the highest level of economic development and greater investment in digital technology, such as the Cloud service investment and Big Data investment. It also has more digital technology resources, especially the amount of "Big Data generation" is very large, much higher than Japan and South Korea, indicating that Singaporeans have a lot of personal applications for digital technologies. But in "e-commerce (online) transaction volume" and "ICT service export", Singapore's performance is weak, indicating that there are fewer commercial applications for digital technology. From the perspective of macroeconomic background, although Singapore's economic development level is very high, its "consumption capacity" is lower than the average, indicating that the people's consumption view is relatively conservative.

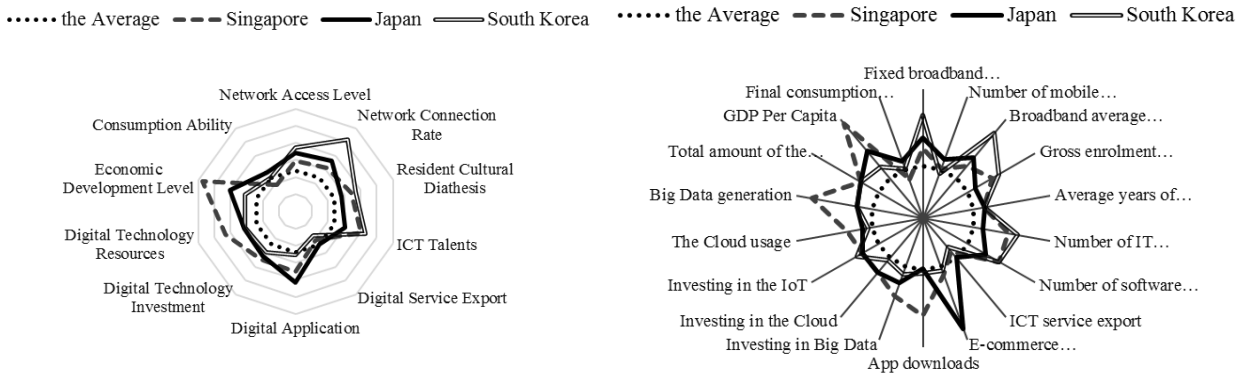

Figure 4-4 The second-class indexes and third-class indexes of Front runners

Japan has advantages for the application of digital technology, especially in "e-commerce (online) transaction volume", which shows that Japan's digital technology for business

applications are better, digital technology. The development of digital technology has promoted the reform of the original business model and produced e-commerce. Japan has seized this opportunity well and has driven the development of the digital economy. Japan's performance on other indicators is more balanced, and digital economy is steadily developing.

In contrast to Japan, South Korea has a weaker application of digital technology and is the weakest performer in digital service exports, below the average. However, South Korea performs well in digital infrastructure construction indicators including "Network Connection Rate", indicating that Korea's Internet construction is better. In particular, the performance of ICT talents in Korea is also excellent, mainly reflected in the "number of IT staff engaged" and "number of software developers". It can be concluded that Korea focuses on the cultivation of digital technology talents, and the IT industry is relatively developed.

4.3 Pursuers' DELI Comparison

As shown in Figure 4-5, Malaysia's consumption level is higher than the average level, indicating that the consumption concept is relatively open. It can reflect the happiness of people's lives to a certain extent. In terms of the application of digital technology, Malaysia's "network access" is relatively high, especially for "the number of mobile broadband Internet users per 100 people", indicating that the network infrastructure construction is better. At the same time, Malaysia's performance in "digital technology applications" is also relatively good, close to the average level, especially in "application downloads", indicating that digital technology is more popular.

Figure 4-5 The second-class indexes and third-class indexes of Pursuers

In contrast, China has an advantage in "digital service export", indicating that China is good at using digital technology to promote economic development, and the export of emerging technology services accounts for a large proportion of total service exports. Meanwhile, China also has advantages in "digital technology investment", especially in "cloud services" and "Internet of Things". This reflects China's emphasis on emerging digital technologies and the

aim to accelerate the development of digital economy.

As pursuers, China and Malaysia are both weak in “economic development level”, “digital technology resources” and “network connection rate”, which are reflected in the low per capita GDP and relatively small amount of big data. It shows that the macroeconomic development environment is not as good as that of the front runners, and the research on emerging digital technology is not as mature as that of the front runners. The basic network construction needs to be strengthened. Although China is now in the period of rapid development of digital technology, the number of ICT personnel and the number of software developers are still insufficient, indicating that China's current ICT employment environment is not mature enough.

4.4 Beginners’ DELI Comparison

As shown in Figure 4-6, India and Indonesia are similar. Except for “consumption capacity” and “digital service export”, the values of other indicators are far from the average level. Especially, India and Indonesia are very weak in the network connection speed, ICT talent, application of digital technology and economic development. “The number of mobile broadband Internet users per 100 people” in Indonesia is very high, but the value of “fixed broadband users” is very low. It may be that Indonesia has a relatively complete infrastructure for mobile broadband networks.

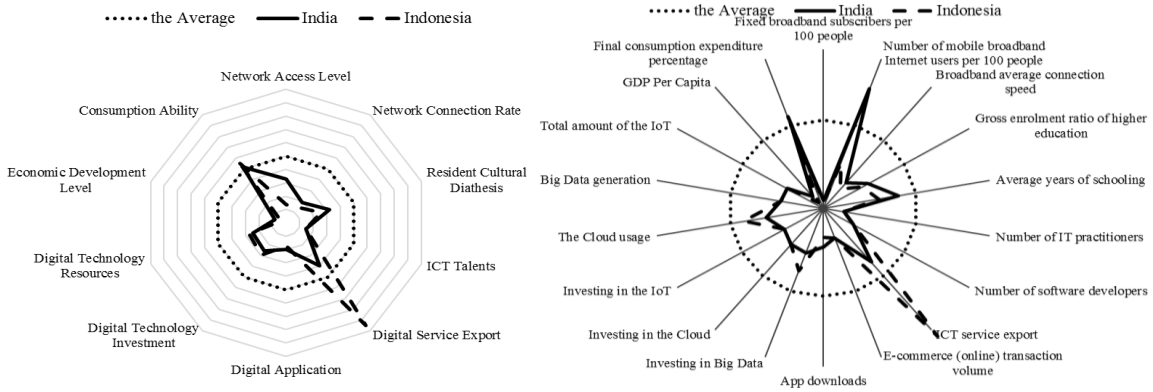

Figure 4-6 The second-class indexes and third-class indexes of Beginners

It is worth noting that India, as a start-up country, has a high value of ICT service exports, which is much higher than the average. This phenomenon may be explained from the perspective of national strategy: India is committed to increasing work opportunities through the operations of other countries., in order to stimulate economic development. In the current wave of emerging digital technology, India's ICT-related service exports will naturally get a larger proportion of total service exports.

4.5 Data Envelopment Analysis

The Data Envelopment Analysis Method (DEA) is a relative effectiveness evaluation

method based on input-output data[13]. Now this method has been widely used in the study of the relative effectiveness and scale benefits of Decision Making Units (DMU) in the case of multiple inputs and multiple outputs. It can judge the extent to which different decision-making units can effectively contribute to the production of output under certain technical conditions.

This paper selects the average data of the secondary indicators of the seven countries: Singapore, Japan, South Korea, Malaysia, China, India and Indonesia, and divides them by weight to eliminate the influence of weights. The seven countries are regarded as seven DMUs.

Considering that input variables are easier to operate than output variables, this paper selects an input-oriented DEA model based on variable returns (VRS). The model theory formula is as follows:

$$Min\theta = \theta_0 - \varepsilon(\sum_{r=1}^{s} s_r^+ + \sum_{i=1}^{m} s_i^-)$$

$$s.t.\begin{cases} \sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = \theta_0 x_{i0} \\ \sum_{j=1}^{n} \lambda_j y_{rj} - s_r^+ = y_{r0} \\ \sum_{j=1}^{n} \lambda_j = 1 \\ \lambda_j, s_i^+, s_r^- \geq 0, \quad i = 1,2,...,m, r = 1,2,...,s, j = 1,2,...,n. \end{cases}$$ Equation（4-1）

After linear programming, the analysis results are shown in Figure 4-7:

EFFICIENCY SUMMARY					
firm	crste	vrste	scale		DEA effectiveness
1	1.000	1.000	1.000	-	effective
2	1.000	1.000	1.000	-	effective
3	0.839	0.871	0.964	irs	ineffective
4	1.000	1.000	1.000	-	effective
5	1.000	1.000	1.000	-	effective
6	1.000	1.000	1.000	-	effective
7	1.000	1.000	1.000	-	effective
Note: crste = technical efficiency from CRS DEA vrste = technical efficiency from VRS DEA scale = scale efficiency = crste/vrste					

Figure 4-7 The analysis results of DEA

As can be seen from the result, except for South Korea, the other six countries are all DEA-effective, of which the input-output ratio are optimized.

The analysis results for China and South Korea are shown in Figure 4-8. China's input-output ratio reaches the optimal, technical efficiency is 1, and the projected value is consistent with the original value, indicating that the input does not need to be equalized compression.

Results for firm: 5
Technical efficiency = 1.000
Scale efficiency = 1.000 (crs)
PROJECTION SUMMARY:

variable		original value	radial movement	slack movement	projected value
output	1	1.130	0.000	0.000	1.130
output	2	0.693	0.000	0.000	0.693
output	3	0.622	0.000	0.000	0.622
output	4	0.982	0.000	0.000	0.982
input	1	0.418	0.000	0.000	0.418
input	2	0.728	0.000	0.000	0.728
input	3	0.411	0.000	0.000	0.411
input	4	0.959	0.000	0.000	0.959

LISTING OF PEERS:

peer	lambda weight
5	1.000

Results for firm: 3
Technical efficiency = 0.871
Scale efficiency = 0.964 (irs)
PROJECTION SUMMARY:

variable		original value	radial movement	slack movement	projected value
output	1	0.687	0.000	0.120	0.807
output	2	1.089	0.000	0.000	1.089
output	3	1.345	0.000	0.000	1.345
input	1	1.932	-0.250	-0.746	0.936
input	2	2.382	-0.308	-1.114	0.960
input	3	1.645	-0.213	-0.283	1.150
input	4	1.940	-0.251	-0.497	1.192
input	5	1.277	-0.165	0.000	1.112

LISTING OF PEERS:

peer	lambda weight
1	0.577
4	0.025
7	0.398

Figure 4-8 The analysis results for China and South Korea

South Korea's technical efficiency is 0.893, pure technical efficiency is 0.871, and scale efficiency is 0.964. It is an increasing return to scale. Because the technical efficiency not equals to 1, South Korea is not effective for DEA. If DMU1-Singapore, DMU4-Malaysia and DMU7-Indonesia are ideal targets, the input compression factors respectively are 0.577, 0.025 and 0.398; the loss of output “Digital Service Export” is 0.120, the adjusted target value is 0.807. The other five input factors including “network access level”, “network connection rate”, “resident cultural quality”, “ICT talent” and “digital technology investment” should be reduced. The ideal input value is 0.936. 0.960, 1.150, 1.192, and 1.112.

In this chapter, this paper compares DELI of Singapore, Japan, South Korea, Malaysia, China, India and Indonesia from different dimensions, and divides them into front runners, pursuers, and beginners. This paper compares and analyzes their performance in various indicators, which provides a basis for putting forward valuable suggestions for the development of China's digital economy.

5. Analysis of the Factors Affecting the Digital Economic Development Index

This chapter will focus on exploring the mechanisms of the digital economy and understanding the impact of changes in digital technology on the level of economic development, including correlation analysis and MATLAB-based fitting curve analysis.

5.1 Correlation Analysis Based on Pearson Coefficient

The degree of correlation between the two variables is measured by the correlation

coefficient, and the most widely used is the Pearson correlation coefficient[14], which is used to test the degree of linear correlation between continuous variables. The correlation coefficient is between (-1) and 1 and its absolute value is closer to 1 to indicate the higher the degree of correlation. The more the absolute value tends to 0, the lower the correlation, the positive and negative signs represent the relevant direction, positive correlation or negative correlation.

According to the Pearson correlation coefficient analysis results, the significance level is 0.000, less than 0.01, showing that the correlation coefficient between “digital infrastructure”, “digital skill training”, “digital technology use”, “digital technology capital” and “economic development level” are positive. The correlation coefficient values between them are 0.943, 0.874, 0.826 and 0.748, indicating that the correlation of them is positive and strong.

5.2 Fitting Curve Analysis by MATLAB

In order to find the influence of each first-class index on the total index value, the curve is fitted by MATLAB software.

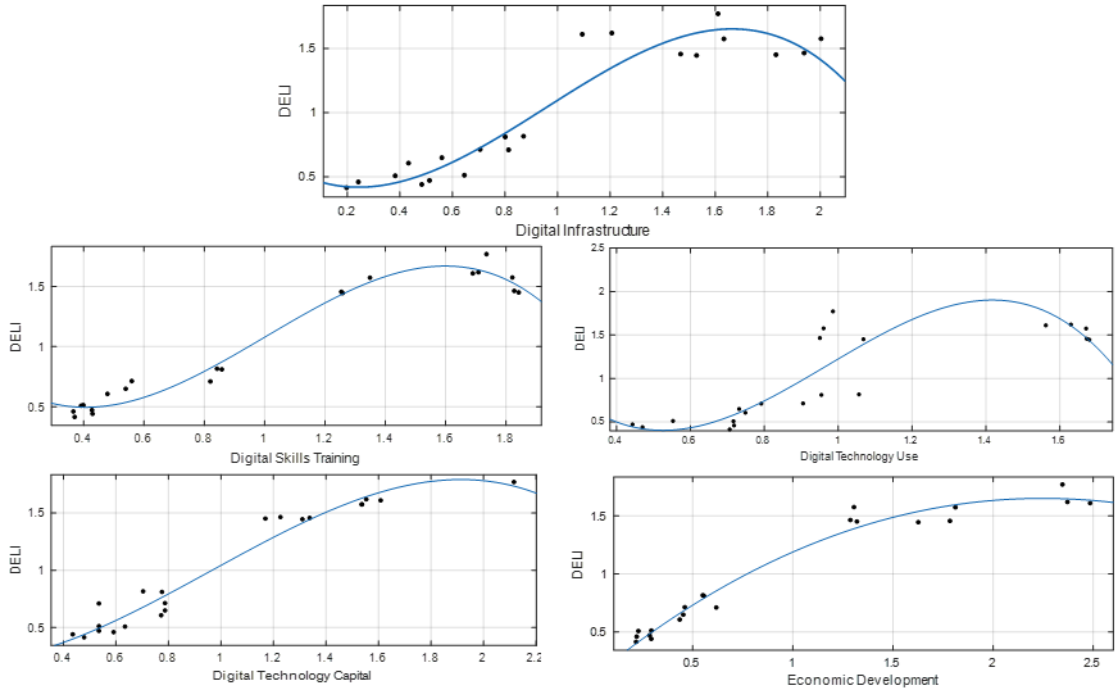

Figure 5-1 fitting curves by MATLAB

As shown in Figure 5-1, the influence of “digital infrastructure”, “digital skills training”, and “digital technology use” on the value of DELI is similar and a bit like S-shaped, indicating that for beginners, “digital infrastructure”, “digital skills training” and “digital technology use” are not the main indicators affecting DELI. But for pursuers, the three first-class indexes play a greater role in promoting digital economy and significantly drive the development of digital economy.

In the meantime, the influence of “digital technology capital” and “economic development”

on the value of DELI is similar. It can be seen from the change of the tangent slope of the curve, whether it is for beginners, pursuers and front runners, the macroeconomic background of economic development has a positive effect on the digital economic development, and this promotion will always exist. “Digital technology capital” also has a positive effect on digital economy, but this promotion will gradually decrease.

6. Policy and Suggestion

Drawing upon the above calculations of digital economy as well as researches and analytics of China, this paper attempts to provide some policy suggestions from the perspective of ICT development to improve China's digital economy development level.

(I) Infrastructure improvement

The results of the previous calculations show that China is in the stage of accelerating, and for pursuers, strengthening digital infrastructure construction has a greater role in promoting the development of the digital economy. The foundation of digital economy development is information and communication technology. Only by building an advanced digital network can we fully utilize the advantages of digital technology and promote the economy development.

China can continue to promote the "four networks integration" including telecommunication networks, radio and television networks, the Internet and the power grid to improve the utilization of communication resources; accelerate the construction and transformation of broadband networks, strengthen network information security and cultural security supervision; actively participate in the standards for next-generation communication networks, accumulate experience for the construction of next-generation communication networks; strive to ensure the openness, transparency and fairness of the communication market to attract more investment, establish infrastructure sharing and effective spectrum management.

(II) Talent education and employment

In contrast, the amount of China's ICT talents is still far less than that of front runners, especially in the number of ICT stuff and software developers. China needs to adjust the education and training system to provide the skills required by digital economy. In order to speed up the training of ICT talents and development, enterprises can improve the talent

incentive mechanism, give the innovative talents greater management control power and technical route decision power, and stimulate innovation vitality. The government should pay more attention to training of talents, establish an early warning mechanism for ICT talents, build a team of digital technology experts, focus on technological change, innovation and job creation. Colleges should attach importance to the training requirements of talents in emerging digital technologies, rationally set up majors and courses, strengthen the construction of teachers, formulate a reasonable teaching management system, and improve the digital technical accomplishment of teachers and students.

(III) Investment in technology and deeper integrated development

Through the analysis of the influencing factors of DELI, it can be found that digital technology capital has a positive effect on the digital economy development. It is an important force to promote China's digital transformation. The rapid development of emerging digital technologies may help break through the bottlenecks encountered by traditional industries. For example, in logistics, digital technology can be used to calculate the fastest route or find the most cost-effective and time-saving route in route planning.

In order to obtain more digital technology resources and generate a powerful driving force for the digital economy development, China should increase investment in emerging digital technologies such as Big Data, the Cloud, IoT, Artificial Intelligence. It is suggested that China give full play to the role of digital technology to lead innovation and comprehensively promote technological innovation, industrial innovation, business innovation, product innovation, market innovation and management innovation. Promoting the integration and penetration of emerging digital technologies and manufacturing, energy, materials, and bio-industry industries, strengthening the application of digital technologies can make a great difference to economic development.

(IV) Enhanced international cooperation and exchange

Digital economy is increasingly dependent on data generation, storage, processing and transmission within and between countries. Therefore, China can use digital technology to promote exports. In the digital age, more and more products are being delivered in digital rather than physical form, and the expansion of e-commerce in the physical product sector means that shipments of small parcels and low-value goods are growing rapidly. The government should deepen its thinking on common issues in the areas of trade logistics, digitization and e-commerce, seize this opportunity, encourage cross-border e-commerce, and create conditions for the booming e-commerce. For example: developing uniform standards and providing

resources. Enterprises should make better use of the Internet to show corporate style internationally, gain the attention of the desired crowd, promote data analysis and collection, and explore customer needs.

(V) Popularized digital applications and promoted digital life

The development of digital economy is closely related to the well-being of people. Paying attention to the use of digital technology into personal applications can improve the quality of our life and benefit us.

Although many lifestyles in China have been digitized, such as shopping on line, ordering meals online, taking taxis online, registering hospitals online, sharing bicycles and sharing cars, indicating the active use of emerging digital technologies by individuals. However, compared with the front runners, there is still a certain gap in the popularity of digital products in China. Relatively speaking, young people have a faster grasp of the use of digital products, but older people and those with lower education levels may have a weaker ability to use these complex digital products. It is suggested that the government take more measures to improve the digital literacy of the entire group. For example, teaching the elderly to use smart products and calling on people to use online shopping, online registration and other personal applications will help people truly feel the convenience brought by digital economy and enjoy the digital life.

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