

# Research on the Mechanism and Path of Digital Economy Enabling China's High Quality Development

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**Abstract:** This paper discusses the mechanism and path of digital economy enabling high-quality development in China, focusing on the relationship between digital economy and high-quality development. In empirical research, this paper selects several typical data of the digital economy as the entry point to measure how the digital economy affects high-quality economic development from the aspects of digital economy infrastructure, digital economy investment, digital science and technology indicators, and industrial growth. This result is always true after selecting statistical data and using principal component analysis. This paper promotes the research on the mechanism of enabling high-quality development of the digital economy, which is very helpful to clarify the understanding of the motivation and impact mechanism of high-quality development in the digital economy.

**Keywords:** Digital Economy; High-quality Development; Path Research

## 1. Introduction

In 1995, the digital economy was first put forward in the form of a concept. The digital economy and its related industries and fields are booming, and the connotation and coverage of the digital economy are deepening. With the passage of time, the digital economy has effectively promoted the improvement of economic efficiency and the optimization of economic structure in the development of modern network and communication technology. At the Fifth Plenary Session of the 19th CPC Central Committee, it was clearly proposed that the economic and social development during the "14th Five Year Plan" period should "focus on promoting high-quality development", which means high-quality development has become the focus and focus of work in the new development stage. The 14th Five Year Plan for the Development of Digital Economy also mentioned that in 2020, the added value of China's core industries in the digital economy will account for 7.8% of GDP, and the digital economy has provided a strong impetus for the sustainable and healthy development of the economy and society. The arrival of the digital economy era is not only the economic growth led by technological innovation, but also the economic growth caused by model transformation and structural upgrading. It is a high-quality growth. By tracking the development trend of digital economy, the research of this project clarifies the impact mechanism of digital economy on high-quality development, designs the specific path of digital economy driving high-quality development, and escorts the digital economy to boost high-quality development.

From the results of digital economy in different fields and the research of scholars from all walks of life, economy is inherently related to trade, investment and other activities, and digital economy is no exception. The existing theoretical studies believe that the specific path of digital economy driving high-quality development is multi-dimensional: on the micro level, with the help of today's Internet technology, it can form an economic environment with economies of scale, economies of scope and long tail effects. Macroscopically, the economic growth led by these technological innovations through new input factors, new resource allocation efficiency and new total factor productivity is also the economic growth caused by model transformation and structural upgrading, which is a high-quality growth.

In the development process of China's digital economy, we also face multiple pressures. First, people in different regions of our country are faced with the problem of serious information asymmetry under the digital economy. The concept is vague and cannot be applied to practice. Secondly, the

development of digital economy is closely related to the economic level and infrastructure. In poor areas, how to share the cost of infrastructure construction required by the digital economy has become a severe test for the development of digital economy. Third, in the digital era, with the trend of "online", how to supervise the economy and finance more efficiently is one of the hottest topics at present. It is difficult to completely supervise enterprises that have violated laws or government regulations and caused damage to people's interests, which is likely to lead to ineffective supervision.

## 2. Journals retrospection

### 2.1. Relevant literature on digital economy

Tapscott Don<sup>[1]</sup>(1996)The concept of digital economy was first put forward, and it is also considered as the father of digital economy. The digital economy includes information and communication technology infrastructure and e-commerce (Brent Moulton, 1999; R Kling, R Lamb, 1999). The Chinese Academy of Information and Communication (2017) uses the informatization index method to measure the development level of China's informatization, and has compiled the Digital Economy Index (DEI) to observe and reflect the development trend of the digital economy; Wu Yilin<sup>[2]</sup>(2019) built a national digital competitiveness measurement index system and compared the digital competitiveness of major countries in the world in 2018. Jing Wenjun and Sun Baowen<sup>[3]</sup>(2019) pointed out that the impact of digital economy on high-quality economic development is multidimensional and complex. At the micro level, emerging technologies such as the Internet can form an economic environment with economies of scale, economies of scope and long tail effects. On this basis, it can better match supply and demand, form a more perfect price mechanism, and thus improve the level of economic equilibrium; At the macro level, we can promote high-quality development in some emerging industries through new input factors, new resource allocation efficiency and new total factor productivity. Xie Xuanli<sup>[4]</sup> (2018), Liang Bang and Zhang Jianhua<sup>[5]</sup>(2019) believe that digital finance is the representative of the financial model in the new digital economy, and the development of digital finance provides new opportunities for solving the financing of small and medium-sized enterprises and promoting innovation and entrepreneurship.

## 3. Basic structure analysis

In the development process of China's digital economy, how to play a role in economic, political and social fields is one of the most critical aspects of the digital economy. Literal analysis of the digital economy by predecessors is the basis for understanding the digital economy. In this part, we will try to use the theory of topology to explain the topological structure in the economic system.

In the transmission of elements of the digital economy, the set of economic elements of each region can be abstracted into an economic system with a topological structure. Inside the system, each input and output has a corresponding relationship. This structure includes many fields such as economy, politics and cultural inertia. The basic process of the transmission model, this paper will introduce the topology model, and use the topology related theory to verify the transmission process of the digital economy in all areas of the region. The model has N input ports, equivalent, and also N output ports. Each input and output port of the model has a relationship. In the input process of different input quantities, the relationship between the input quantity  $I_1$  and the final output quantity  $O_1$  through the topological system in the system is defined as the economic topological structure assumed in this paper.

It can be seen from the above description that the economic topology in this paper is a system that opens all input ports. The basic operation process of the system will be described below (Figure 1), and the operation principle of multi-port topology will be deduced accordingly[6-9].

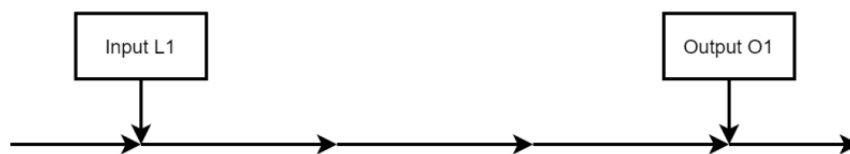


Figure 1: Schematic diagram of topology structure of single input and single output (single layer)

Figure 1 is a topological system composed of a single input and output port. The elements are

relatively simple. A single input quantity is simulated at the input end for input. Through conduction in the system, it finally reaches the output end for output.

This process simulates a relatively closed, monotonic topological system with few external unnecessary economic factors. In the above figure, for example, transmission passes through multiple nodes to generate certain economic variables, simulating the changes of the input economic factors to a specific factor. The final output at the output terminal simulates the final quantitative change of a specific element.

In the case of single input and single output, there is only one single topological relationship.

Similarly, as shown in Figure 2, when there are two input and output ports, there are four topological relationships under the internal changes of the topological system.

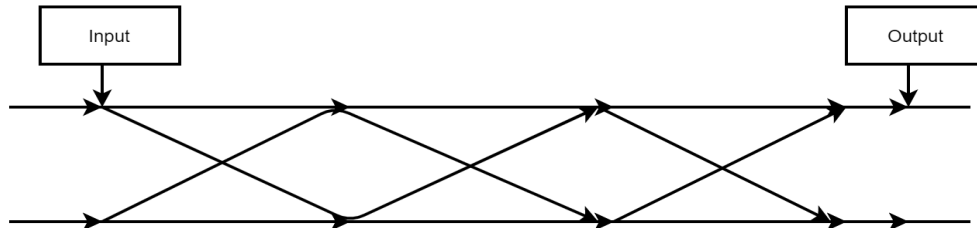


Figure 2: Schematic diagram of input and output (double-layer) topology

From the above description, we can see that when the number of input and output terminals of the topology system increases, that is, the number of topology layers increases, and the complexity of the entire topology system also increases. The topology model is extended to three and four layers. Because each input does not establish a strict one-to-one correspondence with the output. That is, for every input, there may be more than one output through the complex relationship within the system. As shown in Figure 3, in a three-layer system, there are about 43 topological relationships, and in a four layer system, there are about 44 topological relationships. Through induction, assuming that there are  $X$  ports for input and output, and the number of layers is  $Y$ , a simple topological system containing  $XY$  potential topological relationships can be built.

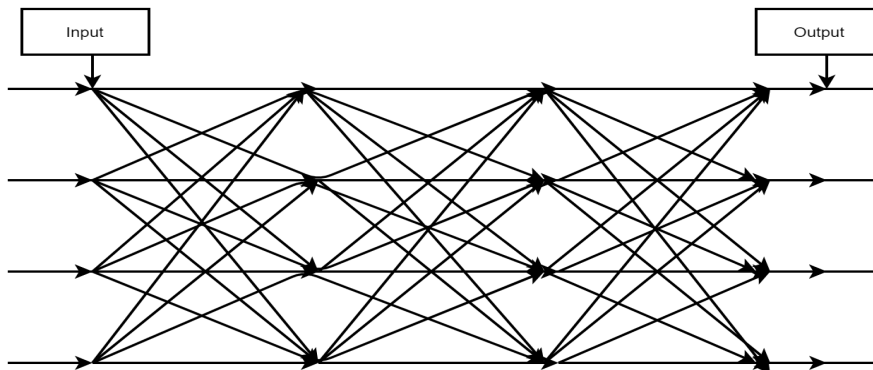


Figure 3: Schematic diagram of input and output (four layers) topology

#### 4. Analysis of model principle

##### 4.1. Model construction

After reviewing the shortcomings of basic topology, the principle of linear algebra is introduced to treat the whole as an algebraic system similar to vector space. The first step is to build a panel model to study the impact of the input values of various elements under the digital economy on the output values of economic topology transmission. The linear model is generally constructed as follows:

Considering that  $I_i$  and  $O_m$  are input and output matrices respectively, there exists a matrix  $A$  ( $N, M$ ) in the topological system

Consider linear combination:  $I_i \in Z$  and  $O_m \in Z(i, m \in [1, n])$

$$O_m = I_i * A \quad (1)$$

$$\sum I_i * A = I_{i1} * A_{1j} + I_{i2} * A_{2j} \dots \dots I_{iN} * A_{Nj} = \sum_{k=1}^N A_{ik} I_{kj} (i, j \in Z) \quad (2)$$

Considering the influence of other factors, the model can be specifically expressed as

$$\sum_{k=1}^N A_{ik} I_{kj} (i, j \in Z) + P + \mu = O_m \quad (3)$$

Among them, matrix A can represent the topological relationship of the surveyed region within a certain period of time,  $I_i$  represents the input of digital economic elements in the region, and P represents the control variables at the macroeconomic level, national policy level, and regional population education level,  $\mu$  is a random error term[10-11].

#### 4.2. Data sources

The research data comes from the provincial annual data in the Digital Economy Development Report (2020-2021) edited by Zhao Yan and the China Statistical Yearbook over the years, as well as the open data of the National Bureau of Statistics. The digital economy is divided into multiple levels of data, including new technologies, new industries and new models in the digital economy era. In the development of multiple digital economies, such as 5G, big data center, and convenient government system, there is a strong multiplier effect, which can greatly promote regional digital transformation.

By the end of 2021, the national mobile phone penetration rate is 116.3 units/100 people, and the Internet penetration rate is 73%. There are 535.79 million Internet broadband access users, including 946.0468 million Internet access ports. The annual mobile Internet user access traffic is 2216000 billion GB. On the other hand, in the post epidemic era, the development of digital economy has brought unprecedented network changes. Home telecommuting, live streaming, online teaching, big data mining and other new economic trends have gradually become new growth points of the digital economy. In 2021, the national online retail sales will reach 13.1 trillion yuan, up 14.1% year on year, 3.2 percentage points faster than the previous year. Among them, the online retail sales of physical goods reached 10.8 trillion yuan, breaking through 10 trillion yuan for the first time, a year-on-year increase of 12.0%, accounting for 24.5% of the total retail sales of consumer goods, and contributing 23.6% to the growth of total retail sales of consumer goods. As an important way to promote "stable growth, employment and consumption", the digital economy provides more ways for China's economic recovery.

In view of the current situation of China's digital economy development, the government still needs to provide digital infrastructure construction for underdeveloped areas to expand the breadth of economic development, popularize the daily application of digital economy for small and medium-sized weak subjects to enhance the depth of economic development; Take multiple measures simultaneously to achieve overall and coordinated economic development.

#### 4.3. Coupling mechanism between model and reality

The rapid application of digital economy has changed the traditional mode of economic growth, but the prosperity of digital economy and economic growth are two sides of the same thing. The growth of new business forms cannot be separated from industrial digitalization, especially the sinking market for the masses, which requires more advanced communication technology, storage media and computing power as support. With the increase of the total amount of digital economy, regional income and national income growth rate, China will accelerate the construction of base stations, layout of data centers, government cloud and other infrastructure and services. It will further drive economic growth.

On the basis of existing services, it is also necessary to continuously improve the quality of digital economy services. The development of the digital economy depends on many known factors, such as the perfection of facilities, the agglomeration effect and radiation of the scale of the digital economy, innovation ability, and patent protection. It is doubtful whether the ability to retain sufficient investment in such construction can be guaranteed. In the process of economic growth, increasing input

factors can improve operational efficiency and promote the improvement of total factor productivity. Back in the topological model, the abstract topological relationship within the system is inseparable from digitization and is not independent. As a key link to internal transmission, the higher the coupling and coordination between the model and reality, the more realistic the model can reflect the relationship between reality.

#### 4.4. Variable measure and description

At present, all elements in the digital economy, as an important part of the sustainable development economy, are under the background of "new infrastructure". The infrastructure construction in the new era determines the openness of this model, which is reflected in the extremely large number of input ports in this model. In contact with the external environment, the model will also be affected by the environment. For example, the new infrastructure construction necessary for the digital economy constitutes an input, mainly including information infrastructure, integration infrastructure and innovation infrastructure. In terms of output, the previous indicators were changed to new indicators such as GDP per capita, 5G per 100 people (5G network penetration), and per capita utilization rate of information industry.

For example, communication network infrastructure represented by 5G, Internet of Things, Industrial Internet, Internet of Everything, new technology infrastructure represented by artificial intelligence, cloud computing, blockchain, and computing infrastructure represented by data center and intelligent computing center. The construction and development level of such facilities represents the key to the digital development of a region, and is also the key standard for evaluating the infrastructure construction level of a region.

In the current limited research, Liu Jun et al. (2020) analyzed China's current digital economy evaluation system from informatization, the Internet and the hottest digital transactions, and measured the digital economy with provincial panel data from 2015 to 2018. Referring to Liu Jun et al. (2020), who took the Internet penetration rate as the core method to measure the comprehensive development level of the digital economy, for the evaluation of the digital economy infrastructure in this paper, five indicators are used: Internet penetration rate, mobile phone penetration rate, Internet broadband access users, mobile Internet users, and mobile Internet access traffic. The above five indicators are to calculate the current coverage of the Internet in all social groups in China, the number of mobile phone users among 100 people, the number of Internet broadband access accounts, the number of mobile Internet access accounts, and the size of mobile Internet access traffic. The original data of the above indicators can be obtained from the China Urban Statistical Yearbook and the database of the National Bureau of Statistics. Through the method of principal component analysis, factor analysis is conducted after the data of the above five indicators are standardized, and finally the contribution of digital economy infrastructure is obtained.

## 5. Analysis of internal relations

From the analysis of the topological model, we can see that matrix A (N, M) is the main reason for the digital gap caused by the digital economy to some extent, that is, the difference between matrix A in different regions is the gap between regions.

Therefore, we can say that when the input quantity I and output quantity O exist, the two quantities are equal and independent of each other.

Relational expression

$$\sum_{k=1}^N A_{ik} I_{kj} (i, j \in Z) + P + \mu = O_m \quad (4)$$

The existence of matrix A makes the difference between input and output. This matrix can be assumed to be a digital divide under objective conditions. This section focuses on the analysis of the gap, and tries to select digital economic indicators to measure the gap. It is impossible to include all economic factors in this section, so this paper selects several typical panel data (2015-2021), takes their average values, and roughly measures them, trying to find their internal relations by using principles. As shown in Table 1 and Table 2.

Table 1: Typical Data of Digital Economy

Typical data of digital economy	Digital economy infrastructure	Internet penetration rate (%)	Number of Internet users among 100 people	61.0
		Mobile phone penetration rate (unit/100 people)	Internet broadband access per 100 households	106.6
		Internet broadband access users (10000 households)	Number of Internet broadband access households	39731.6
		Mobile Internet users (10000)	Number of mobile Internet access accounts	121197.0
		Mobile Internet access traffic (10000 GB)	The size of mobile Internet access traffic	8831722.0
	Digital economy investment	Fixed asset investment in high-tech industry (100 million yuan)		22974.6
		Basic research expenditure of scientific research and development institutions (100 million yuan)		420.735
	Digital technology indicators	Number of high-tech industry research and experimental development institutions		6409.7
	Industrial growth	Value added of primary industry (%)		7.6
		Value added of secondary industry (%)		39.4
		Value added of the tertiary industry (%)		53.0

Table 2: Performance of Digital Economic Growth

Performance of digital economy growth	
GDP (100 million yuan)	Per capita GDP (yuan)
904331.7	64530.4

All data are from: National Bureau of Statistics

Table 3: Descriptive statistics of variables

	minimum value	Maximum	average	standard deviation
Internet penetration	50.30	73.00	60.9714	8.64999
Mobile phone penetration	92.49	116.30	106.5543	9.72665
Internet broadband access users	25946.57	53579.00	39731.5986	10067.80321
Mobile Internet users	96447.16	137851.26	123576.1743	15080.66541
Mobile Internet access traffic	418753.31	22160000.00	8831722.0329	8420127.13135
Investment in fixed assets of high-tech industry	19950.65	39785.95	29666.9429	7215.98790
Basic research expenditure of scientific research and development institutions	295.29	637.53	451.7057	126.34795
Number of high-tech industry research and experimental development institutions	5572.00	7033.00	6498.7143	497.89681
Value added of primary industry	7.00	8.40	7.5857	0.51778
Value added of secondary industry	37.80	40.80	39.4000	0.96090
Value added of the tertiary industry	50.80	54.50	53.0429	1.25148

The 11 indicators of typical data of the digital economy are all from the National Statistical

Yearbook and the official website of the National Bureau of Statistics from 2015 to 2021. Including Internet penetration rate, mobile phone penetration rate, Internet broadband access users, mobile Internet users, and mobile Internet access traffic, are taken from the statistics under the transportation and post and telecommunications columns. The two indicators of investment in fixed assets of high-tech industry and expenditure of basic research funds of scientific research and development institutions are taken from the statistics under the science and technology column. The added value of the primary industry, the added value of the tertiary industry, the added value of industry, and the total economic GDP, per capita wealth, per capita GDP indicators, such as economic growth rate, GDP growth rate, are from China Statistical Yearbook. For missing data, linear interpolation method is used to make up. As shown in Table 3.

Table 4: Initial Solution of Factor Analysis

	start	selection
Internet penetration	1.000	0.932
Mobile phone penetration	1.000	0.924
Internet broadband access users	1.000	0.972
Mobile Internet users	1.000	0.927
Mobile Internet access traffic	1.000	0.855
Investment in fixed assets of high-tech industry	1.000	0.966
Basic research expenditure of scientific research and development institutions	1.000	0.930
Number of high-tech industry research and experimental development institutions	1.000	0.458
Value added of primary industry	1.000	0.554
Value added of secondary industry	1.000	0.617
Value added of the tertiary industry	1.000	0.801

The initial values are all 1, which means that all variables can be explained by factors, and the proportion of variable information extracted is also high. Except for the number of high-tech industry research and experimental development institutions, other extraction ratios are above 0.85 (Table 4).

Here, the information infrastructure represented by Internet penetration rate, mobile phone penetration rate, Internet broadband access users, mobile Internet users, and mobile Internet access traffic represents the possibility for the masses of the people to approach the digital economy, because communication technology is increasingly becoming the transmission subject, and storage business is also moving from the traditional service provider to daily applications. Similarly, because of the existence of the Internet, the gap lies in trying to overcome the Matthew effect and get rid of the uneven distribution of digital resources.

In terms of investment in the digital economy, typical fixed asset investments in high-tech industries and basic research funding for scientific research institutions not only reflect the level of information development in a certain region, but also represent a unique social environment. This is because only when information development reaches a certain stage will there be a relevant awareness of information investment. Influenced by external factors, different regions have varying potential investment depths, which is also the main reason for the gap.

Table 5: Total variance explained by factor analysis

component	Initial characteristic value			Extract sum of squares load		
	total	Variance %	Cumulative %	total	variance %	Cumulative %
1	8.937	81.243	81.243	8.937	86.886	81.243
2	0.825	7.499	88.742			
3	0.656	5.963	94.705			
4	0.568	5.161	99.867			
5	0.010	0.094	99.961			
6	0.004	0.039	100.000			
7	1.245E-15	1.132E-14	100.000			
8	1.626E-16	1.479E-15	100.000			
9	-1.985E-17	-1.805E-16	100.000			
10	-6.392E-17	-5.811E-16	100.000			
11	-3.847E-16	-3.498E-15	100.000			

Finally, in terms of teaching and research, namely the number of high-tech industry research and experimental development institutions and other research indicators, providing high-quality digital

talents and correctly guiding talents to where they need to go is the main solution to promote the gap to be quickly bridged. In addition, national information policies and relevant laws and regulations in the new era are also the main means to address the gap. On the basis of relevant research, the rule of law department needs to accelerate the research in this field of digital economy, which will strengthen the security of China's overall digital economy, more smoothly and efficiently enter the social informatization, economic digitization, and meet the opportunities and challenges of digital globalization.

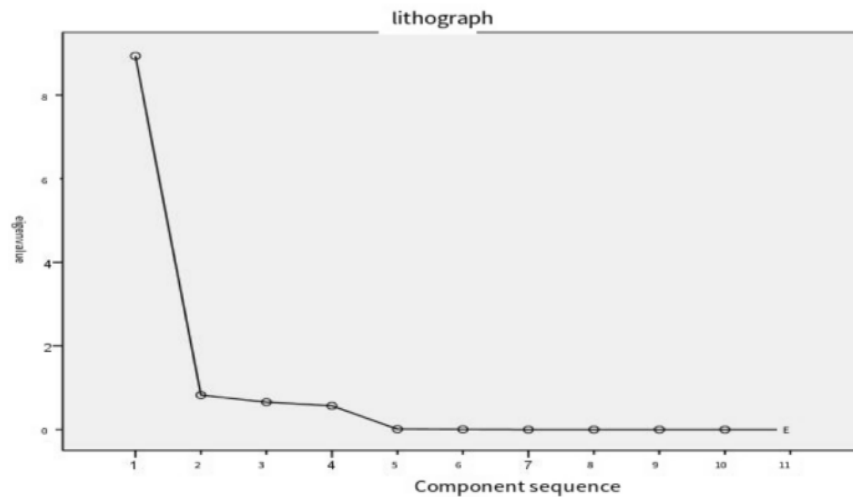


Figure 4: Gravel Diagram

According to the total variance chart explained by factor analysis, the final cumulative contribution rate was 81.243% (Table 5). After the gravel map (Figure 4) shows the fifth factor, the degree of interpretation of the information has been low, and the selected multiple components reflect the sufficient information provided by the original data.

In terms of the final cumulative contribution rate, the larger the scale of the digital economy industry, as long as there are enough input factors, it can have a positive effect on the economy. Of course, the premise is that the impact of the gap should be sufficiently small, so that the more favorable it is for regional economic development, the control variables, input and output have a positive impact on regional economic development, and the feedback transmission path is at least unblocked, which is consistent with the existing theoretical results, and also verifies that China's digital economy can effectively stimulate economic growth, the country and society, and even individuals, Are extremely important in the digital economy. To sum up, the digital divide in China is objective and unbalanced, but digital economic activities can bridge the gap in different regions, make up for the gap and help repair more potential transmission channels, and ultimately have different degrees of positive impact.

### 5.1. The role of digital economy development in the construction of modern economic system

The arrival of digital economy is not only caused by technological innovation, but also by the transformation of development mode and high-quality development caused by industrial digital upgrading. This growth pattern is in line with the report of the 19th National Congress of the Communist Organization of China on building a modern economic system. In order to realize the above characteristics in the process of building a modern economic system, the report of the 19th Congress of the Communist Organization of China pointed out that currently China needs to complete six strategic tasks: deepen the supply side structural reform, accelerate the construction of an innovative country, implement the strategy of rural revitalization, implement the strategy of coordinated regional development, and accelerate the improvement of the socialist market economic system, Promote the formation of a new pattern of comprehensive opening up. These six strategic tasks, in the process of building a modern economic system, make the digital economy as "booster" for rapid economic development, and provide strong support to promote the implementation of corresponding policies.

The integration of digital economic infrastructure and derived emerging technologies such as the Internet, big data and cloud computing with the traditional economy has formed a more open and transparent market environment, which can achieve accurate matching between supply and demand,



reduce transaction costs and improve the price mechanism. The digital economy investment represented by Internet finance flows between industries, regions and the world to promote the coordinated development of industrial structure, urban and rural areas, regions and the outside world. For example, in western China and other regions, local rural specialty goods can be interconnected without reducing efficiency and fairness through the establishment of investment projects of Internet enterprises such as rural Taobao and JD Logistics. From a microscopic perspective, this is the process of making the output close to the capacity and the production point close to the production possibility curve.

## 6. Conclusions and Suggestions

This paper selected China's provincial panel data from 2015 to 2021 for analysis. On the one hand, by constructing a topological model, using factor analysis, regression analysis, significance test, and introducing linear algebra and other tools and analysis methods, this paper considers and studies the industry digitization, digital technology investment, digital infrastructure construction and other aspects in the era of digital economy as a new method. Through the demonstration, the development of digital economy will certainly help promote the common prosperity of all people, and for the less developed areas, people can enjoy the dividends of digital economy to a greater extent when the poverty alleviation campaign is initially effective. On the basis of understanding and explaining the connotation of high-quality economic development in this paper, this paper puts forward the following suggestions to promote China's economy to cross the digital divide and finally achieve high-quality development: first, to meet the people's growing demand for improving life in the economic, political, cultural, social, ecological and other aspects, deepen the structural reform of the supply side, and accelerate the formation of high-quality supply system. Second, we should emphasize the driving role of consumption in economic development, constantly "promote" high-quality demand, and achieve a higher level of supply and demand balance. Third, adhere to the concept of green development, completely abandon the development model of destroying the ecological environment and improving the efficiency of resource utilization, and promote the benign interaction and coordinated development of ecology and economy. Fourth, we should continue to optimize the industrial structure to ensure that the employment situation is steadily improving and prices are generally stable. We will attach great importance to solving debt risks and preventing financial risks to maintain sustained and stable economic growth. Fifth, plan and promote future economic development from a global perspective, adhere to equal emphasis on introducing and realizing the world, actively layout and use international high-quality resources, and promote high-quality development with a highly open attitude. In addition, it is necessary to accelerate the formation of high-quality development indicator evaluation system, performance evaluation system and accounting and statistical system, effectively eliminate the single target evaluation mechanism of GDP, and take optimizing structure, improving efficiency, improving people's livelihood and other indicators and performance as important evaluation contents, effectively enhancing the enthusiasm and initiative of all regions to promote high-quality economic development.

Under the people-oriented care, the main significance of this research is that the digital economy is undeniably the current development trend, which has a positive role in promoting, but in order to achieve relative fairness under the market mechanism, we must continue to refine the research on the digital economy, and must use the invisible hand of the government to participate in the development and guide. The reference topology is to expand economic opportunities, increase input, and at the same time, pay attention to reducing the gap, and try to leverage and guide more new business forms, and develop more transmission paths. Try to make the input and output into a flowing water as much as possible, and make the digital economy into a complete ecological closed-loop, so that it can coordinate with the economic operation and make greater contributions to the stable operation of the economy.

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