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Research on the Influence of Digital Technology on the Development of Common Prosperity

Ji Xia

China University of Mining and Technology, Xuzhou, 221116, China

Abstract: *In the past 30 years, digital technology has gradually established a decisive position in world production with its advantages of high precision, high storage capacity, and high versatility. Meanwhile, it has also become a new driving force for industrial revitalization in the process of China's pursuit of power transformation and shared development. Based on the panel data of 31 provinces and cities from 2013 to 2021, this study uses the entropy method and AHP method to construct the index system of the development level of common prosperity and the level of digital technology. Moreover, through regression analysis, it studies the action mechanism of digital technology on the development of common prosperity. At the same time, the 31 provinces are divided into four typical development regions by systematic clustering method. It is found that digital technology has a significant promoting effect on the development of common prosperity, and the influence has obvious regional and dimensional heterogeneity. Finally, relevant suggestions are given for the development of four typical regions.*

Keywords: *Digital Technology; Common Prosperity; AHP method; entropy method*

1. Introduction

With the continuous development of modern technology, the application modes and scenarios of digital technologies such as big data, cloud computing, the Internet of Things, blockchain, and artificial intelligence are becoming more diversified. Developed countries, represented by the United States and Japan, attach great importance to national economic guidance through digital technology. The CPC Central Committee and The State Council are also improving their decisions and plans on accelerating the development of the digital economy and building a digital society. In the past year, a total of 45 policy documents of The State Council, including the Guiding Opinions of The State Council on Strengthening the Construction of Digital Government, have put forward guiding opinions on promoting the application of digital technology from various perspectives. The specific policy guidelines include the promotion of digital government management services, the construction of the national emergency system, and other institutional management. It also encourages the application of digital technology in the management service of housing provident funds and the deep integration with human resources management service. Under the influence of the digital environment and the support of central policy, digital applications, and development in recent years have gradually become hot topics for experts and scholars. Since 2018, the number of core literature related to word frequency at home and abroad has increased sharply, focusing on the technical research of computer software application and architecture fields: The number of articles related to digital technology will increase from 275 in 2018 to 651 in 2022, and the predicted number will exceed 700 in 2023.

The concept of "common prosperity" first appeared in the Party's formal literature in 1953. After years of development, it has gradually developed a complete meaning and connotation: it means that all people, through hard work and mutual help, will eventually achieve a standard of living with adequate food and clothing, that is, universal prosperity based on the elimination of polarization and poverty. The 2035 target emphasizes that "the proportion of middle-income groups will be significantly increased, and the gap between urban and rural development and between regions and between people's living standards will be significantly narrowed."In recent years, the practical experience of years of intensive cultivation and common prosperity has ushered in a spurt of growth: in 2021, China's per capita GDP reached 12,551 dollars, ranking among the middle and upper-income countries; Solid progress was made in new-type urbanization. By the end of 2021, 64.72% of China's permanent residents had been urbanized, an increase of 11.62 percentage points over the end of 2012. From 2013 to 2020, 98.99 million people in rural areas were reduced from poverty. But at the same time, it still faces numerous difficulties. Taking Jiangsu Province as an example, the gap between urban and rural per capita disposable income is still expanding

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year by year from 2010 to 2021, and the growth rate is slowing down year by year.

The concept of "common prosperity" first appeared in the formal documents of the Party in 1953. After years of development, it gradually has a complete meaning and connotation: that is, all the people through hard work and mutual help eventually achieve a living standard of ample food and clothing, that is, universal prosperity based on eliminating polarization and poverty; Common prosperity. In various policy documents, especially the 2035 and 2050 targets set out in the report to the 19th CPC National Congress. Both China and China embody the requirements of improving people's lives, narrowing the gap, and achieving common prosperity."The proportion of middle-income groups has increased significantly, the development gap between urban and rural areas and between regions, and the poor living standards of the people," the target said. The distance decreases significantly. The practical experience of years of deep cultivation and common prosperity has ushered in a blowout growth in recent years: In 2021, China's per capita GDP will reach $12,551, ranking among middle and upper-income countries. Solid progress in new urbanization. By the end of 2021, the urbanization rate of permanent residents will be 64.72%, an increase of 11.62 over the end of 2012. A point of separation; From 2013 to 2020, 98.99 million rural people were reduced from poverty, and absolute poverty was eliminated historically. Divide by and so on; But at the same time, it still faces numerous difficulties. Take Jiangsu Province as an example, the per capita of urban and rural areas between 2010 and 2021. The disposable income gap is still widening year by year, and the growth rate is slowing down year by year.

At the critical stage of China's transition, although the economy has been improving for a long time, the problem of unbalanced and inadequate development is still very significant. In the face of such a dilemma, the CPC Central Committee's Proposal on Formulating the 14th Five-Year Plan for National Economic and Social Development and the long-term Goals for 2035, adopted at the Fifth Plenary Session of the 19th CPC Central Committee in 2021, put forward a new development idea -- Digital China Strategy: accelerating digital development."Suggestions" emphasizes that accelerating the development and application of digital technology will greatly expand people's living radius, break regional barriers and constraints of time and space, penetrate all aspects of people, and play an important role in bridging the gap between regional material supply and demand, bridging the gap between urban and rural cultural development and other issues. With the progress of the digital China strategy, digital technologies such as big data, cloud computing, the Internet of Things, blockchain, and artificial intelligence can be applied to every inch of China and shared with every person in China, satisfying the vision and pursuit of a better life of people in different parts of the same sky, we have reason to make bold assumptions: With the help of digital technology, common prosperity will surely make historic progress."

2. Literature review

First of all, digital technology is the use of "0" and "1" two digital codings, through the computer, optical cable, a communication satellite, and other equipment to express the market stack, transmission, and processing of information technology, generally including digital coding, digital compression, digital transmission, digital modulation, and demodulation technology. Key digital technologies include 3D technology, virtual reality technology, digital image technology, multimedia technology, digital content management, and release technology, 3S technology (RS technology, GIS GIS and GPS) and broadband network technology, etc[1]. The digital economy is also one of the key concepts in the research process: Digital economy is composed of digital industrialization and industrial digitalization, among which digital industrialization mainly includes the core industries of the economy, including the digital manufacturing industry, digital product service industry, digital technology application industry, and data factor-driven industry. Industrial digitalization refers to the output increase and efficiency improvement brought by the application of digital technology and data resources to traditional industries. It's the integration of digital technology and the real economy[2]. However, there is no clear definition of the digitalization level of a city at present, and most studies evaluate it from three dimensions: digitalization input, digitalization output, and digitalization application[3].

At the same time, to sort out the relationship between digital technology and common prosperity, it is necessary to fully understand the connotation of common prosperity and to summarize the relevant evaluation and measurement methods. Liu Peilin et al. (2021) [4] believe that the harmonious and stable social structure in which the middle-income class is the main body in quantity is the social connotation of common prosperity, and "achieving common prosperity with more balanced and sufficient high-quality development" is our primary task. On this basis, the author proposes a common prosperity index system: That is, from the overall degree of prosperity and the sharing of development results from two

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dimensions; However, Li Shi (2021)[5] fully considered the impact of the phased advance of common prosperity on the measurement results when constructing the index system, and specified the indicators of common prosperity in three dimensions, namely income, property and basic public service, according to the development stage. At present, the basic conditions for the development of common prosperity are not optimistic. Relative to the wealth of the whole people, the gap in the degree of sharing is more obvious. In addition, the income gap between Chinese residents remains high, and the problem of inequality in basic public services is serious.[4-7]

Finally, this paper aims to explore the measurement of digital technology on the level of regional common prosperity. Through literature review, this relationship is summarized into the following aspects; Firstly, there are two main methods to study the effect of digital technology on common prosperity at the macro level. The first is theoretical logic analysis. Guo Aijun et al. (2022)[8], starting from the basic framework of institutional distribution, speculated on the realization mechanism of digital technology to promote common prosperity by studying the three paths of market transformation, financial income increase, and social value reconstruction. The second type of empirical analysis is widely used at present. Liu Rongzeng et al. (2022)[9] constructed a detailed index system of the digital economy and common prosperity and proved that common prosperity is promoted by optimizing resource allocation and improving technological innovation level after analyzing provincial panel data. Xiang Yun et al. (2022)[10] pay more attention to the heterogeneity of regional digital development level and common prosperity and believe that regional digital level not only directly promotes common prosperity, but also affects industries

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In addition to the above studies on the measurement of the macro level of digitalization, some kinds of literature choose to study the path of common prosperity through digitalization in subdivided fields: Yang Wang et al. (2022)[2], from the perspective of industry, analyzed the influence mechanism of industrial digitalization in promoting common prosperity from four aspects: innovation effect, spillover effect, synergy effect, and sharing effect. As the future development trend, the digital economy has significantly changed the important position of production factors such as labor and land and saved more costs. Therefore, Deng Shijun et al. (2022) [15]adopted an empirical analysis method based on the economic cost perspective to analyze the influence mechanism of the digital economy on common prosperity from four dimensions production, circulation, consumption, and distribution. Fang Mingyue et al. (2022) [16], based on an enterprise perspective, proved that digital transformation of enterprises can improve employee income and reduce the labor gap by improving productivity and employee autonomy, providing multiple approaches and policy enlightenment for enterprises to promote common prosperity. From the perspective of medical health, Tei and MensahJustice[17] studied the relationship between mobile network expansion and infant mortality and proved that digital technology can expand the opportunity for underserved people to obtain medical services and improve the sharing level of people. Meanwhile, the proper application of digital technology can effectively improve the mental health of subjects. Significantly improve their quality of life[18].

ISSN 2616-5902 Vol. 5, Issue 13: 63-76, DOI: 10.25236/AJBM.2023.051310

After the literature review, existing studies have provided profound theoretical references for this study, but the existing literature has not directly established the correlation between the level of regional digital sharing and the realization of common prosperity, the influence between the two, and the intermediate transformation mechanism. This study focuses on making up for this research deficiency.

3. Data collection and analysis

3.1 Model assumption

To explore the impact of digital development level on the development of common prosperity, the following model is constructed, reference[10]

$$Cp_{it}=a_0+a1Dig_{it}+a2Fdi+a3\,Fis+a4\,Ina+a5Ug+a6Pop \quad (1)$$

i is a province, t is time, Cp is common prosperity, and dig is common prosperity development.

3.2 Variable setting

3.2.1 Establishment of an evaluation index system for common prosperity

Table 1: Evaluation index system of common prosperity level.

classification	Index type	Index name	variable	Index attribute
affluence	Indicators of economic development	GDP per capita	CP1	Positive
		The ratio of value-added of the tertiary industry to GDP	CP2	Positive
		Per capita disposable income of all residents	CP3	Positive
	Public service indicator	Teacher-to-student ratio in ordinary high school	CP4	Positive
		The teacher-student ratio in ordinary primary schools	CP5	Positive
		Number of health professionals per 10,000 people	CP6	Positive
		Number of medical institution beds per 10,000 people	CP7	Positive
	Infrastructure index	Passenger turnover	CP8	Positive
		Per capita has public library holdings	CP9	Positive
		Internet broadband access users	CP10	Positive
	Ecological environment index	Per capita park green space	CP11	Positive
		Harmless treatment rate of household garbage	CP12	Positive
		Green coverage of built-up areas	CP13	Positive
Degree of sharing	Difference degree index	Ratio of per capita disposable income of urban and rural residents (Rural residents 1)	CP14	Negative
		The ratio of consumption level of urban and rural residents (rural residents 1)	CP15	Negative
	Commonality index	The proportion of local government spending on social security and employment in GDP	CP16	Positive
		Personal income tax as a percentage of revenue	CP17	Positive
		Expenditure of social pension funds for urban and rural residents as a percentage of GDP	CP18	Positive

Common affluence is the organic unity of common and affluence. This paper mainly refers to Han Jianyu et al. (2023)[19], Xiang Yun et al. (2022) [10], and Liu Peilin et al. (2021) [4] to construct an

ISSN 2616-5902 Vol. 5, Issue 13: 63-76, DOI: 10.25236/AJBM.2023.051310

evaluation index system of common affluence level from two dimensions of affluence and sharing degree, and further subdivides it into 6 index types and 18 specific indicators. The strategic goal of common prosperity focuses on the people's needs for a better life and is closely related to the five-sphere overall plan for economic, political, cultural, social, and ecological development. In this paper, the index construction of the degree of affluence is based on the "five-in-one" overall layout. After a summary, economic development, public service, infrastructure, and ecological civilization are selected to depict the degree of affluence: By referring to Han Jianyu et al. (2023) [19], the indicators of economic development were constructed and three indicators were set, including per capita GDP, the ratio of added value of tertiary industry to GDP and per capita disposable income of all residents. By referring to Xiang Yun et al. (2022) [10] and Sun Hao et al. (2022) [20], the public service indicators are constructed, mainly covering the level of medical treatment and education. Four indicators are set, namely, the teacher-student ratio in ordinary high schools, the teacher-student ratio in ordinary primary schools, the number of health technicians per 10,000 people, and the number of beds in medical institutions per 10,000 people. Referring to Han Jianyu et al. (2023) [19] and Xiang Yun et al. (2022) [10], this paper describes infrastructure indicators mainly from the perspective of transport, post and telecommunications, and urban civilization, and sets three indicators: passenger turnover, per capita possession of public libraries and Internet access users. The construction of the ecological environment index mainly refers to Li Ruisong et al. (2023) [21]. From the perspective of resources and environment, three indicators are set: per capita green area of the park, harmless treatment rate of household garbage, and green coverage rate of built-up area. While "making the pie" bigger through achieving prosperity, we also place greater emphasis on dividing the pie well, that is, raising the level of sharing so that the fruits of development will benefit more people and achieve maximum equity. The index construction of sharing degree in this paper is based on Han Jianyu et al. (2023) [19]. Two sub-dimensions of different degrees and a common degree are set. The degree of commonality mainly reflects the effect of a series of national policies to reduce the gap and improve the level of sharing in table1.

3.2.2 Construction of digital development level evaluation index system

At present, there are few studies on the development and construction of digitalization levels in the literature and the scale is relatively simple. This paper mainly refers to Li Haihai et al. (2023) [1]and Xiao Jing et al. (2023) [3]to set three index types of digitalization application popularization, digitalization input, and digitalization output, which are further subdivided into seven indicators. The popularity of digital applications is represented by the proportion of enterprises with e-commerce transactions and the penetration rate of mobile phones. Starting from the three aspects of people, finance, and material input of each province, the digital investment is described by selecting the indicators of information transmission, software and information technology service industry urban unit employment (10,000), mobile phone exchange capacity, and long-distance optical cable line length.In terms of digital output, inter-provincial output results were measured from the perspective of total volume and per capita, and two indicators were selected, the ratio of e-commerce transactions to GDP and per capita telecom business volume.The details are shown in the table 2.

Table 2: Digital technology development level evaluation index system.

classification	Index name	variable	Index attribute
Digital application popularization index	Mobile phone penetration	Dig1	Positive
	The proportion of enterprises with e-commerce transactions	Dig2	Positive
Digital input index	Employment in information transmission, software, and information technology services in urban units	Dig3	Positive
	Mobile phone exchange capacity	Dig4	Positive
	Length of long-distance optical cable	Dig5	Positive
Digital output index	The ratio of e-commerce transactions to GDP	Dig6	Positive
	Telecommunications traffic per capita	Dig7	Positive

3.2.3 Control variable

To explore the influence of digital development level on common prosperity in a more comprehensive way, the following control variables are selected for reference to part of the literature[9, 10]: (1) Level of

ISSN 2616-5902 Vol. 5, Issue 13: 63-76, DOI: 10.25236/AJBM.2023.051310

foreign investment (FDI): Foreign investment plays a significant role in promoting regional economic development by introducing advanced foreign technologies[22]. Reference [9]uses the ratio of total foreign investment to GDP as an indicator of foreign investment level. (2) fiscal intervention: The government plays a crucial role of "redistributor" in the process of common prosperity. Adjusting the "unfair opportunity", promotes the rapid development and common prosperity of less developed areas [23]. This index refers to the ratio of fiscal expenditure to GDP [9]. (3) innovation capability: the improvement of scientific and technological innovation strategy and system is the fundamental support for the realization of common prosperity [24]. This paper uses the number of patent grants to describe innovation capability. (4) Industrial upgrading: from the perspective of industry, the transformation and upgrading of traditional industries will promote new industries, new forms, and models, strengthen the new engine of economic development [25], and inject continuous vitality for common prosperity. In this paper, the ratio of the output value of the tertiary industry to the output value of the secondary industry is used to measure [9]. (5) population: Population per km^2.

3.2.4 Descriptive statistics of variables

In this paper, the panel data of 31 provinces in China from 2013 to 2019 are collected from China Statistical Yearbook and the provincial Statistical Yearbook. The details are shown in the table 3.

Table 3: Entropy method of commonwealth index weight.

Index name	Entropy method weight	Index name	Entropy method weight
GDP per capita	5.79%	Internet broadband access users	17.26%
The ratio of value-added of the tertiary industry to GDP	0.70%	Per capita park green space	1.19%
Per capita disposable income of all residents	4.92%	Harmless treatment rate of household garbage	0.22%
Teacher-to-student ratio in ordinary high school	0.86%	Green coverage of built-up areas	0.25%
The teacher-student ratio in ordinary primary schools	0.53%	Ratio of per capita disposable income of urban and rural residents (Rural residents 1)	0.56%
Number of health professionals per 10,000 people	1.44%	The ratio of consumption level of urban and rural residents (rural residents 1)	4.51%
Number of medical institution beds per 10,000 people	12.07%	The proportion of local government spending on social security and employment in GDP	12.68%
Passenger turnover	14.76%	Personal income tax as a percentage of revenue	9.73%
Green coverage of built-up areas	9.78%	Expenditure of social pension funds for urban and rural residents as a percentage of GDP	2.75%

The entropy method is a method to judge the degree of dispersion of indicators. Its weight is finally obtained by measuring the degree of change of indicators. Indicators with greater relative change have greater weight. Through sorting out the data of 18 indicators of common prosperity in 33 provinces and cities from 2021 to 2013, the entropy method was used to analyze the weight of each index.

According to the results, the top five indicators that have a great impact on the comprehensive index of common prosperity are Internet broadband access users (17.26%), tourist turnover (14.76%), number of beds in medical institutions per 10,000 people (12.68%), public library per capita (12.07%) and the proportion of personal income tax in tax revenue (9.78%). The next five are the ratio of value-added of the tertiary industry to GDP (0.70%), the ratio of per capita disposable income of urban and rural residents (0.56%), the ratio of teachers to students in ordinary primary schools (0.53%), the green coverage of built-up areas (0.25%), and the harmless disposal rate of household waste (0.22%). According to the index type analysis, the index weight of infrastructure and people's living common degree is larger, while the related indexes of ecological environment and people's living difference have less influence.The

ISSN 2616-5902 Vol. 5, Issue 13: 63-76, DOI: 10.25236/AJBM.2023.051310

details are shown in the table 4.

Table 4: AHP method to calculate the weight of the digital index.

First-order index	First-order index weight	Secondary index	Secondary index weight	Comprehensive weight
Digital application popularization index	6.67%	Mobile phone penetration	25.00%	1.67%
		The proportion of enterprises with e-commerce transactions	75.00%	5.00%
Digital input index	46.67%	Employment in information transmission, software, and information technology services in urban units	60.00%	28.00%
		Mobile phone exchange capacity	20.00%	9.33%
		Length of long-distance optical cable	20.00%	9.33%
Digital output index	46.67%	The ratio of e-commerce transactions to GDP	50.00%	23.33%
		Telecommunications traffic per capita	50.00%	23.33%

The indexing measurement of the digital development level is calculated by the AHP method. The AHP method is a method to determine each index by expert scoring. It is subjective to a certain extent.The details are shown in the table 5.

Table 5: Variable description summary.

Variable class	Variable name	symbol	Sample size	Mean value	Standard deviation	Minimum value	Maximum value
Explained variable	Index of common affluence level	CP	279	0.73	2.25	0.04	0.48
Core explanatory variable	Digital technology development level index	Dig	279	0.50	1.47	0.20	0.23
Control variable	Level of foreign investment	Fdi	279	0.76	47.82	0.05	3.50
	Degree of government intervention	Fis	279	0.29	1.35	0.11	0.20
	Innovation ability	Ina	279	1.15	9.81	0.00	1.60
	Industrial upgrading	Ug	279	1.42	5.24	0.67	0.73
	population	Pop	279	0.45	1.27	0.03	0.29

3.3 Empirical analysis

3.3.1 Regression analysis result

The index is analyzed by Matlab software, and the output results are as follows:

$$Cp_{it}=0.4458+0.0878Dig_{it}-0.004Fdi-0.399Fis+0.091Ina+0.132Ug-0.396Pop \quad (2)$$

$R^2=0.7208$, $F=117.04$, $P=2.179e-72\approx0.000$

The correlation degree of this equation is high, and the test results are significant.

3.3.2 Robustness test

3.3.2.1 Add variables to form indicators

Reference [3, 9] . Starting from the development level of the Internet, this paper selects "Internet broadband access users (10,000 people)" as the type index of digitalization popularization and synthesizes the new digitalization level index. After regression analysis, the results are as follows

$$Cp_{it}=0.44+0.12Dig_{it}-0.004Fdi-0.399Fis+0.084Ina+0.131Ug-0.47Pop \quad (3)$$

$R^2=0.7283$, $F=121.50$, $P=5.557e-74\approx0.000$

ISSN 2616-5902 Vol. 5, Issue 13: 63-76, DOI: 10.25236/AJBM.2023.051310

The test results are significant.

3.3.2.2 Delete four municipalities

Reference[10]: The economic development level of Beijing, Tianjin, Shanghai, and Chongqing is at the forefront of the country, and the application level of digital technology is higher, which may have a stronger impact on common prosperity. To ensure the universality of the results, the data of the four municipalities were deleted, and the results after regression were as follows:

$$Cp_{it}=0.51+ 0.12Dig_{it}-0.0031Fdi -0.21 Fis + 0.074Ina -0.02Ug -0.32Pop \quad (4)$$

$$R^2=0.7083 ,F=93.8828 \quad P\approx0.0000$$

The test results are significant.

3.3.2.3 The entropy method is used to calculate the digital level index

There are some problems in AHP statistics, among which the key is the subjective determination of the scale of quantitative indicators [26]. Different scoring criteria will produce a variety of results. To ensure the reliability of the conclusion, the entropy method was adopted to carry out weight analysis on the index system, and the results were as follows in the table 6.

Table 6: Entropy method of digital technology development level index weight.

Index name	Entropy method weight
Mobile phone penetration	1.20%
The proportion of enterprises with e-commerce transactions	4.90%
Employment in information transmission, software, and information technology services in urban units	28.80%
Mobile phone exchange capacity	10.70%
Length of long-distance optical cable	9.60%
The ratio of e-commerce transactions to GDP	23.60%
Telecommunications traffic per capita	21.20%

According to the results of calculation by entropy method, it can be seen that the ratio of e-commerce transactions to GDP and the weight of employment personnel in urban units of information transmission, software, and information technology services are relatively large, which are 28.80% and 23.60% respectively. The index weights of mobile phone penetration rate and enterprises with e-commerce transactions are relatively low, only 1.20% and 4.90%. Among them, the digitalization input index has the largest weight (49.10%), followed by digitalization input (44.80%), and digitalization application popularization only accounts for 6.10%. The results of the entropy method are roughly consistent with those of the AHP method, but the subtle differences between different indicators are tested and subjective factors are excluded, so the results are more accurate. After Matlab regression, the results are as follows:

$$Cp_{it}=-0. 046+ 0.076Dig_{it}-0.004Fdi -0.399 Fis + 0.091Ina + 0.132Ug -0.395Pop \quad (5)$$

$$R^2= 0.721, F= 117.02, P= 2.219e-72\approx0.000$$

The correlation degree of this equation is high, and the test results are significant.

3.3.3 Heterogeneity test

To ensure the universality and reliability of the results, the entropy method is adopted for the weights of the following data.

3.3.3.1 Regional heterogeneity

To visually display the development of common prosperity at the provincial level, the index system is used to statistically plot the common prosperity level of 31 provinces in 2015-2021. As can be seen from Figure 1, the common prosperity level of all provinces in the statistical year has been improved, but there are obvious differences in development, showing a structure of "faster in the east and slower in the west". Hot spots such as the eastern Yangtze River Delta and the Bohai Sea Rim, such as Beijing, Shanghai, Jiangsu, and Guangdong, have a sound foundation for common prosperity and are developing rapidly. The central belt, such as Henan, Jiangxi, and other common prosperity levels, slow development; However, some western inland provinces such as Guizhou, Qinghai, Xizang, and others provinces have

ISSN 2616-5902 Vol. 5, Issue 13: 63-76, DOI: 10.25236/AJBM.2023.051310

a poor foundation of common prosperity and slow development.

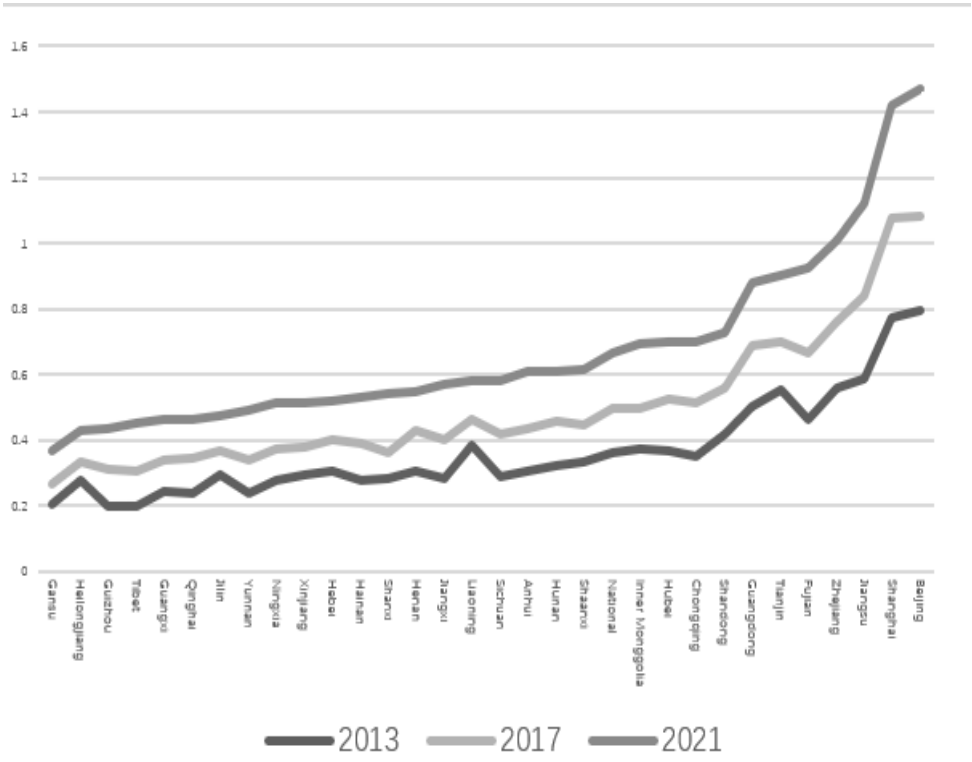

Figure 1: The national commonwealth level from 2015 to 2021.

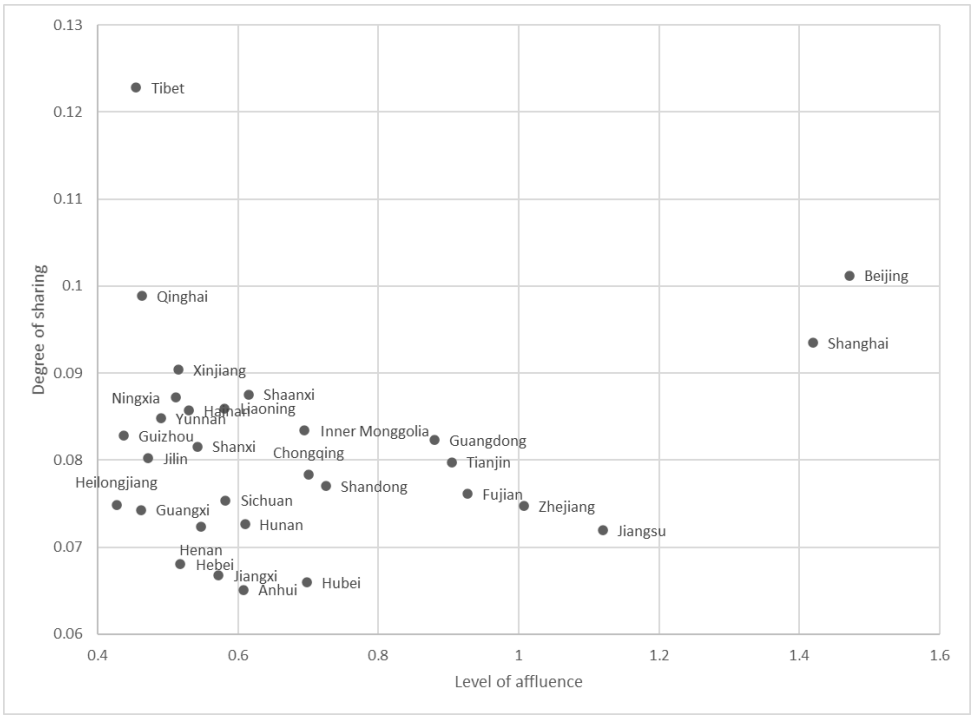

Figure 2: 2021 Provincial and municipal common prosperity dimension information analysis chart.

As can be seen from Figure 2, the affluence degree gradually declines from the eastern coastal areas to the western inland areas. There is a big difference between the degree of sharing and the degree of wealth, showing a trend of "West → East →Middle". The sharing level of most western regions is above medium, while the sharing level of several eastern rich regions such as Jiangsu and Zhejiang is slightly lower, while the sharing level of most central cities is the lowest. Beijing and Shanghai are among the top cities in China in terms of wealth and sharing.

ISSN 2616-5902 Vol. 5, Issue 13: 63-76, DOI: 10.25236/AJBM.2023.051310

To more accurately distinguish the regional differences between common prosperity and digitalization, this paper refers to the practice of Cheng Lanfang et al. (2022) [27], which conducts systematic clustering of Chinese provinces according to the common prosperity index and digitalization level index data of 31 provinces and cities in 2021, and finally divides them into four main regional types and describes their main characteristics:

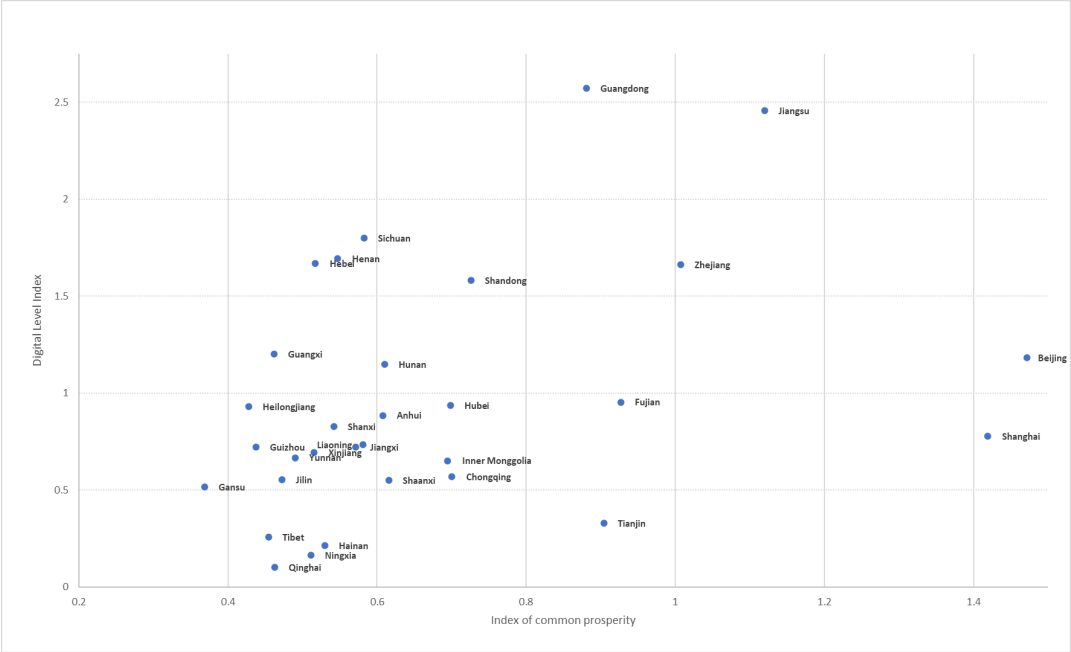

Figure 3: Scatter chart of the provincial composite index.

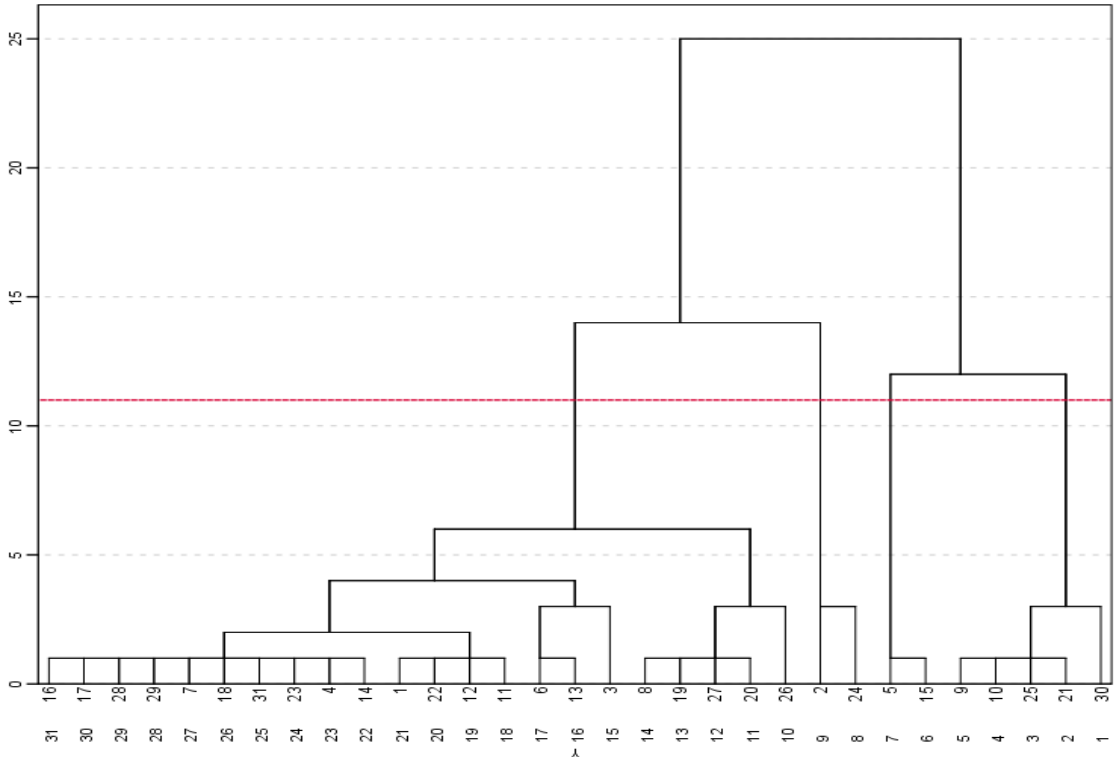

Figure 4: Cluster analysis diagram.

Refer to Figure 4 cluster analysis diagram, each adjacent province is not adjacent geographically, but its digitalization level is highly similar to the level of common prosperity, and each subcategory is finally clustered into four main types through continuous merging.

ISSN 2616-5902 Vol. 5, Issue 13: 63-76, DOI: 10.25236/AJBM.2023.051310

Table 7: Cluster area basic information.

Area type	Difference comparison of clustering category variance analysis (mean ± standard deviation)	Regional feature	The number of provinces included	Inclusive province
I	Common prosperity level=0.57±0.14 Digital technology development level=0.65±0.30	Common prosperity is low and digital development is low	22	Anhui, Fujian, Gansu, Guangxi Zhuang Autonomous Region, Guizhou, Hainan, Heilongjiang, Hubei, Hunan, Jilin, Jiangxi, Liaoning, Inner Mongolia Autonomous Region, Ningxia Hui Autonomous Region, Qinghai Province, Shanxi Province, Shaanxi Province, Tianjin Municipality, Tibet Autonomous Region, Xinjiang Uygur Autonomous Region, Yunnan Province and Chongqing Municipality
II	Common prosperity level=1.45±0.03 Digital technology development level=0.98 ±0.20	Common prosperity high digital development is slightly lower	2	Beijing and Shanghai
III	Common prosperity level=1.00±0.12 Digital technology development level=2.51±0.06	Common prosperity is high, digital development is high	2	Guangdong Province and Jiangsu Province
IV	Common prosperity level=0.68±0.18 Digital technology development level=1.68±0.07	Common prosperity is slightly lower than digital development	5	Hebei, Henan, Shandong, Sichuan, and Zhejiang provinces

In 2021, the common affluence index of 31 provinces in China is 0.67±0.27, and the digital technology development level index is 0.96±0.61. After observing Figure 3 and difference comparison of clustering category variance analysis, the regional characteristics of the four categories of regions are obtained: The number of categories I am the largest, which mainly includes inland provinces in the north and ethnic minority provinces in the south. The scatter diagram of the composite index of the reference provinces is mainly distributed in the lower left corner. The difference comparison shows that this region has the characteristics of low common affluence and low digital development. Category II only includes Beijing and Shanghai, which, as the political and economic centers of China, have a significantly higher degree of common prosperity than other provinces. The reason may be that their rapid economic growth and a strong degree of prosperity have a significant impact on the common prosperity index, but their degree of digital development is not high. Category III only includes Guangdong Province and Jiangsu Province. Although the level of common affluence is slightly lower than that of Category II, it still ranks at the top in China and has obvious advantages in the development level of digital technology. The reason may be that Guangdong's advantageous geographical location and the introduction and innovation of science and technology, while Jiangsu's outstanding educational advantages and human resources are the foundation of digital technology research. Category IV mainly includes Henan, Hebei, and other five provinces and cities, the level of common prosperity is not high, and the level of digital technology development is slightly lower than that of Category III.The details are shown in the table 7.

Regression analysis was carried out for region I

$$Cp_{it}=0.499+ 0.179Dig_{it}+0.002Fdi -0.21 Fis + 0.25Ina - 0.002Ug -0.72Pop \quad (6)$$

$$R^2= 0.6841, F= 68.964, P= 3.488e-45\approx 0.000$$

Regression analysis was carried out for region II

$$Cp_{it}=-2.889+ 0.477Dig_{it}-0.157Fdi +1.354Fis + 0.272Ina + 0.034Ug+12.883Pop \quad (7)$$

$$R^2= 0.977, F= 79.41, P= 2.062e-08\approx 0.000$$

ISSN 2616-5902 Vol. 5, Issue 13: 63-76, DOI: 10.25236/AJBM.2023.051310

Regression analysis was carried out for region III

$$Cp_{it}=0.666+ 0.117Dig_{it}-0.113Fdi -1.908Fis + 0.03Ina + 0.808Ug-0.874Pop \quad (8)$$

$$R^2= 0.93, F= 24.18, P= 9.941e-08\approx 0.000$$

Regression analysis was carried out for region IV, The details are shown in the table 8.

$$Cp_{it}=0.274+ 0.021Dig_{it}-0.057Fdi -1.013Fis + 0.095Ina + 0.271Ug-0.088Pop \quad (9)$$

$$R^2= 0.956, F= 137.63, P= 3.233e-08\approx 0.000$$

On the whole, the regression coefficients of digital technology development are positive, indicating that the development of digital technology in different types of regions has a promoting effect on common prosperity. Moreover, according to the size of the regression coefficient, the impact on the common affluence level of Class I and II regions is significantly higher than that of Class III and IV regions. For the regions with lower development of digital technology, the empowering effect of common affluence is stronger. The details are shown in the table 8.

Table 8: Cluster regional heterogeneity regression results.

Area type	I	II	III	IV
Intercept term	0.499	-2.889	0.666	0.274
Dig	0.179	0.477	0.117	0.021
R^2	0.6841	0.977	0.93	0.956
Sample size	199	19	19	46
P	0.00	0.00	0.00	0.00

3.3.3.2 Dimensional heterogeneity

Table 9: Dimensional heterogeneity regression results

Dimension type	Digital popularization	Digital input	Digital output
Intercept term	0.110	0.446	0.448
Dig	0.246	0.076	0.056
R^2	0.780	0.721	0.840
Sample size	280	280	280
P	0.00	0.00	0.00

Concerning the fractal heterogeneity study conducted by Xiang Yun et al. (2022) [10], the influence was studied from three dimensions of digitalization level, and the following results were obtained after regression respectively, the details are shown in the table 9.

On the whole, digitalization popularization, digitalization input, and output all have significant promoting effects on common prosperity. Moreover, according to the size of the regression coefficient, the enabling effect of digital input and digital output on regional common prosperity is higher than that of digital popularization.

4. Research Conclusions and Suggestions

4.1 Research conclusions

Based on the panel data of 31 provinces and cities from 2013 to 2021, this paper constructs the index system of digital development level and common prosperity development level, quantifies the influence of digital development level, and then analyzes the development level of common prosperity, drawing several conclusions:(1) In terms of development, from 2013 to 2021, the common prosperity level of all provinces increased gradually, but the development among provinces was extremely unbalanced, and there was a development trend of "high in the east and low in the west, fast in the east and slow in the west";(2) According to the regression results, it can be seen that the digital technology level has a significant positive promoting effect on the development of common prosperity at the national level, and the promoting effect is similar in the four types of regional level. (3) There is heterogeneity in the development of digital technology to promote common prosperity. In terms of the four types of regions, the empowerment of digital technology for the commonwealth level of Class I and II regions is higher than that of Class III and IV regions, especially for Class II regions (Beijing and Shanghai), and the positive influence is extremely prominent. Moreover, compared with the popularization level of digital application, digital input and application output levels of digital technology have significantly stronger

ISSN 2616-5902 Vol. 5, Issue 13: 63-76, DOI: 10.25236/AJBM.2023.051310

effects on regional common prosperity.

4.2 Suggestion

Based on the impact of digital technology on common prosperity, this paper provides several suggestions for improving regional development imbalance and income gap, to promote the development process of common prosperity in China. (1) Coordinated development and development of common prosperity according to local conditions: Due to the differences in geographical location, natural resources, and cultural culture, the common prosperity level of geographical regions varies greatly. The eastern region has a higher economic level, a sound foundation for common prosperity development, and a higher level of people's prosperity than the western region, so more attention should be paid to improving the degree of sharing; For the underdeveloped areas with common prosperity in the west, developing rural economy according to local conditions and improving the utilization rate of resources will greatly improve the economic situation. (2)Promote the development of digital technology: The development of digital technology plays a significant role in promoting the four types of regions in the country. For the situation of common prosperity and low level of digital development in region I, it is the priority to vigorously develop productivity, promote the upgrading of traditional industries through digital technology, and extend the development of back-end chain industries, such as tourism and health, based on the scale development of basic industries. At the same time, it encourages trans-regional economic cooperation and accelerates industrial transformation and development through technical exchange and talent support. The affluence and digital foundation and development of regions II and III are in good condition, and attention should be paid to the issue of regional people's distribution, on the one hand, to do a good job in social security, improve the construction of infrastructure, public services and ecological civilization, on the other hand, to build an income adjustment mechanism that is appropriate to economic development, reduce the income gap and alleviate the distribution problem; 'how to achieve digital technology of popularization, sharing the achievements of science and technology, thus improving the level of common prosperity' is the key topic to accelerate the development of IV region. There is no doubt that: increasing the investment in universities, increasing the cultivation of high-quality technical talents, promoting the landing of digital technology industry, and the deep integration of industry, academia and research will surely promote the completion of the issues rapidly.

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