Study on the coupling coordination degree between digital sharing of social public resources and urban-rural integration development in China

Shengzhu Li [a], Wei Tan [b]

Chongqing University of Posts and Telecommunications, Chongqing 400065, China

[a] 1424822853@qq.com, [b] 870143811@qq.com

Abstract. In digital clarify public resources and the coupling mechanism of urban and rural integration development, on the basis of establishing evaluation index system, using the entropy method to measure China's 30 provinces social public resources sharing digital level and the level of urban and rural integration development, by using the coupling coordination degree model and spatial doberman model, the analysis of features of the two coupling coordination and its influencing factors. The results show that the level of digital sharing of social public resources and the coupling coordination degree of urban-rural integration development increased with fluctuation from 2015 to 2019. The national average coupling coordination degree is near disordered. From the perspective of spatial evolution, the overall coupling coordination degree presents a spatial pattern of "high in the east and low in the west". Areas with high coupling coordination degree show the characteristics of central polarization relying on urban agglomeration, while areas with low coupling coordination degree show the characteristics of regional locking.

Keywords: Digital sharing of social public resources; Integrated urban-rural development; Coupling coordination.

1. Introduction

The definition of public resources originated from economics. Based on different research perspectives, scholars have different understandings of the concept of social public resources. The social public resources studied in this paper are part of the social resources, which can be shared and shared by the whole society and provide production and living services for residents, mainly including education, science and technology, culture, medical and health care, etc. Scholars' research on digital sharing of social public resources mainly focuses on sharing level measurement, sharing mechanism establishment and influencing factors. Many scholars put forward that networking can promote the sharing of social public resources, and the digital sharing of public resources contributes to the integrated development of urban and rural areas. Urban-rural integration is an inevitable trend of rural development [1-3]. The mechanism of urban-rural resource sharing and urban-rural integration should be established so that people in remote rural areas can share the same public service resources like education and medical care as those in cities [4]. Scholars build an index system of urban-rural integration development based on the level measurement and influencing factors of urban-rural integration development, and use global principal component analysis [5- 7] and entropy method [8] to evaluate the level of urban-rural integration development at the national or regional level and analyze influencing factors of urban-rural integration development. And the realization path of promoting urban-rural integration is investigated from the perspectives of economy, space, society and ecology [9].

On the whole, in terms of the research on the relationship between social public resource sharing and urban-rural integrated development, there are many research achievements focusing on the resource sharing of urban-rural integrated development, but few researches explore the path of urban-rural integrated development based on the study of the coupling coordination between the two under the background of rural revitalization strategy. Based on this, this paper focuses on the relationship between digital sharing of social public resources and urban-rural integration development in China, explores the coupling coordination degree between digital sharing of social public resources and

urban-rural integration development in different provinces and regions, and analyzes the main influencing factors of coupling coordination degree. The purpose is to promote the coordinated development of the two systems and provide path reference for rural revitalization and digital China construction.

1.1 Index System construction

Considering the availability and accuracy of data and combining the connotation of digital sharing of social public resources and integrated development of urban and rural areas, this study constructs a comprehensive evaluation index system of the two systems. Among them, the digital sharing of social public resources is designed from the four dimensions of education, science and technology, culture, and medical and health care. Reference for urban and rural integration development system level, the State Council on establishing and perfecting the urban and rural integration development system's opinions on mechanism and policy system, and draw lessons from the related scholars research, from the infrastructure, ecological environment, economy and public service four dimensions, construct evaluation system of urban and rural integration development (see table 1).

Table 1. Comprehensive evaluation index system of digital sharing of social public resources and urban-rural integration development

The target layer	Structural index layer	Specific indicators
Digital sharing of social public resources	Education career	Education digital construction level Digital education development level Level of digital sharing of educational resources
	Science and technology	Technological digitization construction level The development level of digital technology Level of digital sharing of scientific and technological resources
	Cultural undertakings	The level of digital cultural services Level of development of digital culture Digital sharing of cultural resources
	Health care	Health digital construction level The level of digital development in health Health digital sharing level
Integrated urban-rural development	infrastructure	Internet penetration rate in urban and rural areas Smart phone Penetration rate Number of domain name 4 g penetration Internet Broadband Coverage)
	The economic development	Level of development of digital industry Urban and rural disposable income ratio Per capita information consumption of urban and rural residents Scale of e-commerce GDP per capita Online Retail sales
	Social construction	Level of digital government construction Number of websites per 100 enterprises Proportion of enterprises with e-commerce activities Digital standard of living
	The ecological environment	Air quality compliance rate Solid waste treatment rate Forest coverage

1.2 The research methods

1.2.1 Entropy value method

In order to objectively and accurately evaluate the level of digitalized urban and rural sharing of social public resources, the entropy method is used to analyze the dispersion degree of indicators and assign the weights of indicators. First of all, in order to eliminate the influence of different dimensions on the data of each indicator, the extreme value method is adopted to conduct dimensionless processing on the original data, and the data standardized processing formula is as follows:

$$X'_{ij} = \begin{cases} \frac{X_{ij}-\min(X_{ij})}{max(X_{ij})-min(X_{ij})}, \\ \frac{\max(X_{ij})-X_{ij}}{max(X_{ij})-min(X_{ij})}, \end{cases} \quad (1)$$

$$e_{ij} = -k\sum_{i=1}^{m} P_{ij}\, Inp_{ij} \quad (2)$$

$$\mathrm{K} = \frac{1}{Inm} \quad (3)$$

$$w_j = \frac{(1-e_j)}{\sum_{j=1}^{n}(1-e_j)} \quad (4)$$

I is the evaluation object, j is the evaluation index; X_{ij} and X'_{ij} represent the initial and normalized corresponding index values, respectively.

1.2.2 Coupling coordination degree model

In order to more accurately measure the coupling and coordination relationship between digital sharing of social public resources in various provinces and cities in China and urban-rural integration development, the following model is constructed:

$$D(x,y) = \sqrt{C * T} \quad (5)$$

$$C = 2\sqrt{(u_1 * u_2)/(u_1 + u_2)^2} \quad (6)$$

$$T = \alpha u_1 + \beta u_2, \alpha + \beta = 1 \quad (7)$$

D is the coupling coordination degree of x and Y system; C is coupling degree; T is the coordination index. U_1 and U_2 are the comprehensive evaluation indexes of social public resource digital sharing system and urban-rural integration development system respectively. α and β are the importance indices of the two systems respectively. In this study, digital sharing of social public resources and urban-rural integration development are equally important, so α and β are 0.5 respectively.

2. Results analysis

2.1 Comprehensive analysis of digital sharing of social public resources and urban-rural integration development

2.1.1 Analysis of digital sharing level of social public resources

On the whole, the digital sharing level of social public resources in China had a small decline in 2016, but the overall level continued to rise sharply. From 2015 to 2019, the digital sharing level of social public resources in China rose from 0.1486 to 0.1961, with a net increase of 0.0475 or 31.97% (see Table 2). In 2019, guangdong had the highest level of sharing (0.6586), and Qinghai had the lowest level of sharing (0.0641), with a difference of 0.5945, indicating that the level of digital sharing of social public resources varies greatly among regions. The extreme difference between 2015 and 2019 increased from 0.5377 to 0.5945. It shows that the differences of digital sharing of social public resources between provinces and cities are increasing gradually.

Table 2. Digital sharing level of social public resources

	2015	2016	2017	2018	2019
Beijing	0.5705	0.4987	0.4538	0.5927	0.6238
Tianjin	0.3984	0.4346	0.2105	0.1842	0.2833
Hebei	0.0745	0.0629	0.0776	0.1025	0.1205
Shanxi	0.0964	0.0931	0.1309	0.1122	0.1276
Inner Mongolia	0.1215	0.1118	0.0931	0.1096	0.1156
liaoning	0.0946	0.1031	0.0919	0.1647	0.1435
Ji Lin	0.0761	0.0636	0.0603	0.0747	0.0917
Heilongjiang	0.0753	0.0727	0.0915	0.0974	0.1023
Shanghai	0.3603	0.2633	0.2534	0.2780	0.3645
Hiangsu	0.1913	0.1693	0.1766	0.2766	0.3095
Zhejiang	0.2649	0.1833	0.2161	0.3316	0.4337
Anhui	0.0988	0.0925	0.0808	0.1065	0.1516
Fujian	0.1470	0.1064	0.3958	0.1287	0.1101
Jiangxi	0.0782	0.0774	0.0841	0.3442	0.1537
Shandong	0.1183	0.0944	0.0935	0.1322	0.1633
Henan	0.0988	0.0868	0.0827	0.1334	0.1676
Hubei	0.1742	0.1602	0.1079	0.1601	0.1912
Hunan	0.1014	0.0841	0.0859	0.1240	0.1521
Guangdong	0.4022	0.4101	0.4766	0.4879	0.6586
Guangxi	0.0755	0.0612	0.0675	0.1108	0.1398
Hainan	0.1116	0.0577	0.0726	0.1031	0.0993
Chongqing	0.1624	0.1395	0.1421	0.1963	0.2247
Sichuan	0.1023	0.1958	0.1248	0.3769	0.2907
Guizhou	0.0530	0.0495	0.0401	0.0607	0.0761
Yunnan	0.1322	0.0580	0.0528	0.0794	0.1211
Shaanxi	0.0847	0.1472	0.1015	0.1413	0.1513
Gansu	0.0328	0.0354	0.0407	0.0698	0.0775
Qinghai	0.0408	0.0434	0.0380	0.0559	0.0641
Ningxia	0.0533	0.0479	0.0448	0.0731	0.0919
Xinjiang	0.0661	0.0655	0.0559	0.0836	0.0828
The national average	0.1486	0.1356	0.1348	0.1764	0.1961

2.1.2 Analysis on the level of urban-rural integration development

The average scores of all provinces in 2015 and 2019 were 0.2735 and 0.2967, respectively, showing an upward trend (see Table 3). From 2015 to 2019, the development level of urban-rural integration showed a fluctuating growth, which was attributed to the cyclical fluctuation caused by the lag of the adjustment and optimization of urban and rural structure of various provinces and cities by national policies. In 2019, Guangdong had the highest level of urban-rural integration development, with 0.8470; Xinjiang has the lowest level of urban-rural integration development (0.1098). The difference between the two provinces and cities is huge, the former is 7.71 times of the latter. In 2015 and 2019, the range value and coefficient of variation of national urban-rural integration development level were 0.7674 and 0.7323, respectively, and 0.6789 and 0.6032, respectively. Both range value and coefficient of variation showed a decreasing trend, that is, the urban-rural integration development level gap between provinces and cities gradually narrowed, and the coordination of regional development increased.

Table 3. Development level of Urban-rural integration in China

	2015	2016	2017	2018	2019
Beijing	0.7106	0.6940	0.6483	0.6517	0.7150
Tianjin	0.2909	0.2835	0.2707	0.2797	0.2709
Hebei	0.1657	0.1888	0.1919	0.1986	0.2172
Shanxi	0.1308	0.1232	0.1090	0.1283	0.1368
Inner Mongolia	0.1576	0.1555	0.1546	0.1575	0.1691
liaoning	0.2960	0.2483	0.2278	0.2196	0.2512
Ji Lin	0.1918	0.1918	0.1716	0.1745	0.1932
Heilongjiang	0.1706	0.1568	0.1551	0.1473	0.1831
Shanghai	0.5360	0.5922	0.5184	0.5221	0.5532
Hiangsu	0.5397	0.5251	0.5264	0.5367	0.5438
Zhejiang	0.5975	0.6060	0.5649	0.5700	0.5998
Anhui	0.1846	0.2089	0.2287	0.2499	0.2593
Fujian	0.3996	0.4399	0.4567	0.4411	0.4338
Jiangxi	0.1771	0.1653	0.1624	0.1753	0.2055
Shandong	0.3534	0.3753	0.3718	0.3945	0.3854
Henan	0.1839	0.1938	0.2153	0.2305	0.2206
Hubei	0.2544	0.2747	0.2516	0.2548	0.2897
Hunan	0.1981	0.2277	0.2441	0.2586	0.2628
Guangdong	0.8445	0.7949	0.7848	0.7990	0.8470
Guangxi	0.1547	0.1643	0.1736	0.1885	0.2049
Hainan	0.2104	0.2199	0.1985	0.2007	0.2194
Chongqing	0.2126	0.2309	0.2396	0.2578	0.2669
Sichuan	0.2519	0.2515	0.2614	0.2774	0.3054
Guizhou	0.1313	0.1355	0.1750	0.1882	0.2008
Yunnan	0.1738	0.1646	0.1726	0.1732	0.1988
Shaanxi	0.2222	0.2179	0.1853	0.2032	0.2321
Gansu	0.0797	0.0853	0.1026	0.1084	0.1140
Qinghai	0.1390	0.1283	0.1474	0.1646	0.1628
Ningxia	0.1349	0.1385	0.1266	0.1458	0.1492
Xinjiang	0.1130	0.1091	0.0823	0.0898	0.1098
The national average	0.2735	0.2764	0.2706	0.2796	0.2967

2.2 Analysis on the coupling and coordination relationship between digital sharing of social public resources and urban-rural integration development

2.2.1 Time series analysis

At the national level, the coupling coordination degree of digital sharing of social public resources and urban-rural integration development from 2015 to 2019 was distributed in the range of 0.2261 to 0.8642 (see Table 4), involving seven coordination levels of moderate disorder, mild disorder, near disorder, barely coordinated, primary coordination, intermediate coordination and good coordination. From 2015 to 2019, the coupling coordination degree between digital sharing of social public resources and urban-rural integration development showed a slow rising trend, rising from 0.4228 to 0.4680, an increase of 10.67%. In the sample period, a total of 17 provinces and cities realized the transition in the coupling stage, while other provinces and cities did not experience the transition in the coupling coordination stage, but the coupling coordination degree increased to varying degrees. In 2015, the coupling coordination range and variation coefficient of digital sharing of social public resources and urban-rural integration development were 0.5719 and 0.3301, respectively. In 2019, the coupling coordination range and variation coefficient of digital sharing of social public resources and urban-rural integration development were 05576 and 02999, respectively. It can be seen that the gap of coupling coordination degree between provinces and cities is narrowing.

Table 4. Coupling coordination degree between digital sharing of social public resources and urban-rural integration development

	2015	2016	2017	2018	2019
Beijing	0.7979	0.7670	0.7365	0.7883	0.8172
Tianjin	0.5835	0.5925	0.4886	0.4764	0.5264
Hebei	0.3333	0.3301	0.3494	0.3777	0.4022
Shanxi	0.3351	0.3272	0.3456	0.3464	0.3635
Inner Mongolia	0.3720	0.3631	0.3463	0.3625	0.3739
liaoning	0.4091	0.4000	0.3804	0.4361	0.4358
Ji Lin	0.3476	0.3323	0.3189	0.3378	0.3648
Heilongjiang	0.3367	0.3268	0.3451	0.3461	0.3700
Shanghai	0.6629	0.6284	0.6020	0.6173	0.6701
Hiangsu	0.5668	0.5460	0.5522	0.6207	0.6405
Zhejiang	0.6307	0.5773	0.5911	0.6593	0.7142
Anhui	0.3675	0.3728	0.3687	0.4039	0.4453
Fujian	0.4923	0.4651	0.6521	0.4881	0.4675
Jiangxi	0.3430	0.3363	0.3419	0.4956	0.4216
Shandong	0.4522	0.4338	0.4318	0.4779	0.5008
Henan	0.3672	0.3601	0.3653	0.4188	0.4385
Hubei	0.4588	0.4580	0.4059	0.4494	0.4851
Hunan	0.3765	0.3720	0.3806	0.4232	0.4471
Guangdong	0.7634	0.7556	0.7820	0.7902	0.8642
Guangxi	0.3287	0.3166	0.3291	0.3801	0.4114
Hainan	0.3914	0.3356	0.3464	0.3793	0.3842
Chongqing	0.4310	0.4237	0.4296	0.4743	0.4948
Sichuan	0.4007	0.4711	0.4250	0.5687	0.5458
Guizhou	0.2888	0.2861	0.2894	0.3270	0.3516
Yunnan	0.3893	0.3125	0.3090	0.3424	0.3939
Shaanxi	0.3704	0.4232	0.3704	0.4116	0.4328
Gansu	0.2261	0.2345	0.2543	0.2949	0.3066
Qinghai	0.2744	0.2732	0.2735	0.3098	0.3196
Ningxia	0.2912	0.2854	0.2743	0.3214	0.3422
Xinjiang	0.2940	0.2908	0.2604	0.2943	0.3088
The national average	0.4228	0.4132	0.4115	0.4473	0.4680

2.2.2 Spatial analysis

(1) The coupling coordination degree shows a spatial distribution characteristic of "high in the east and low in the west". In general, the coupling coordination in eastern China is much higher than that in central and western China. From 2015 to 2019, the coupling coordination degree values of the three regions showed an upward trend over time, but in the coupling coordination degree of the same period, the coupling coordination degree in the western region was the lowest, and the digital sharing level of social public resources in the eastern and central regions was 1.45 times and 1.58 times of that in the western region. In terms of the mean value of regional coupling coordination degree, the mean value of coupling coordination degree in the eastern region was 0.5520, which was barely coordinated, far higher than the national mean value of coupling coordination degree (0.4326). The mean values of coupling coordination degree in central and western China were 0.3812 and 0.3505 respectively, both lower than the national mean. In 2015, the difference between the coupling coordination degree of the eastern region and the central and western regions was 0.1865 and 0.2197, respectively. In 2019, the difference between the coupling coordination degree of eastern China and the coupling coordination degree of central and western China was 0.1669 and 0.1947, respectively, and the variation coefficient of the coupling coordination degree of the three regions decreased from 0.2288 in 2015 to 0.1837 in 2019. From the perspective of regional difference and regional variation coefficient, the three regional coupling coordination degree gap is gradually narrowing.

(2) Areas with high coupling coordination degree show the characteristics of central polarization relying on urban agglomeration. On the whole, the coupling coordination degree between digital sharing of social public resources and urban-rural integration development in China is developing in a benign direction, but there are differences in the development speed and development level among regions. The regions with high coupling coordination degree are mainly in the east, showing obvious central polarization characteristics. Among them, Beijing and Guangdong are taken as the growth poles of coupling coordination degree, relying on the Beijing-Tianjin-Hebei cluster and the Guangdong-Hong Kong-Macao urban agglomeration, and driving the surrounding areas to improve coupling coordination degree through trickle-down effect and demonstration effect. Relying on the Yangtze River Delta, Zhejiang province promotes the growth of coupling coordination degree of surrounding areas through radiation driving effect. The radiation driving effect of other regions is weak, which is related to the policy making in the early years. The urban-rural integration development of the eastern region mainly relies on market mechanism and forms a composite system through industrial agglomeration, while other regions mainly rely on their own resource advantages, which is the driving effect of the core growth pole. Therefore, in order to realize the coordinated development of the two systems, it is necessary to rely on the existing regional planning, cultivate growth poles, point with axis, axis with area, and realize the comprehensive improvement of the coupling coordination degree of digital sharing of social public resources and urban-rural integration development.

(3) The regions with low coupling coordination degree show the characteristics of regional locking. The provinces with low coupling coordination have been distributed in the central and western regions for a long time, showing a certain low value locking characteristics. From the perspective of the change of coupling coordination type, the moderately maladjusted provinces are all concentrated in the western region, while the majority of the mildly maladjusted provinces belong to the western region. Moreover, the development trend of these provinces is slow, and the coupling coordination value of most western regions is still at a low level in the whole research range. Chongqing and Sichuan province benefited from the western development policy and the development of Chengdu-Chongqing economic circle, and realized the significant transition of coupling coordination degree. Other provinces are still in a mildly dysfunctional coupling phase. Due to the economic development of central and western provinces itself is poorer, science and technology innovation ability is insufficient, lead to the Midwest share digital level is poorer, and the basis of the urban-rural integration development in western China is weak, the relationship between urban and rural areas to rural basic to the city of unidirectional flow is given priority to, not form a complementary between urban and rural areas, the common prosperity of the new relationship between urban and rural areas, As a result, the comprehensive development index of the two systems advances slowly and the coupling coordination degree is low.

3. Sunmmary

First, from 2015 to 2019, the coupling coordination degree of digital sharing of social public resources and urban-rural integration development showed an upward trend of fluctuation. With 2017 as the inflection point, the coupling coordination degree of digital sharing of social public resources and urban-rural integration development was on the verge of imbalance. The degree of coupling coordination is between mild maladjustment and good coordination, and the phenomenon of bipolar pattern is prominent. Over time, the dominant type changed from mild disorder to near disorder. Moreover, the differences between the digital sharing of social public resources and the coupling coordination degree of urban-rural integration development between provinces and cities are gradually narrowing.

Second, from the perspective of spatial evolution, areas with high coupling coordination degree of social public resources digital sharing and urban-rural integration development coupling coordination system show the characteristics of central polarization relying on urban agglomeration, while areas

with low coupling coordination degree show the characteristics of regional locking. Digital specific view, social public resources and the coupling coordination degree of urban and rural integration development high concentration are distributed in the eastern coastal area, and the agglomeration effect continues to strengthen, digital gradually formed the public resources and the consciousness of coupling coordination degree of urban and rural integration development, the central and western regions are mostly low and low concentration, "polarization" phenomenon is serious. The coupling coordination degree of digital sharing of social public resources and urban-rural integration development presents a spatial pattern of east, West and step decreasing.

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