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Characteristics and influencing factors of digital rural development

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Abstract: In order to provide economic policymakers with a comprehensive understanding of the current status of the development of the digital economy and the factors affecting it, and to grasp the key to accelerating the development of the digital economy, we need to achieve rural revitalization, and common prosperity. Based on the Ali County Digital Countryside Index, the article takes Guangxi, China, as an example, to use exploratory spatial analysis to explore the spatial correlation characteristics of the development level of digital countryside construction in Guangxi counties, and to use the spatial lag model is used to analyze the five aspects of economic foundation, industrial structure, education level, government support and population size that affect Guangxi's digital countryside. The results show that: 1) There is a significant positive spatial correlation in the development level of digital rural areas in Guangxi, and the agglomeration effect of high and low values is significant. 2) The per capita economic base, primary and tertiary industry development levels, and education level have a significant role in promoting the development of digital rural areas in Guangxi, while population size is negatively correlated with digital rural areas in Guangxi counties, and the impact of government support is unclear. The research conclusions of this article can provide reference materials for the development of digital economy.

1. Introduction

Digital countryside is an advanced rural form that can promote future development. Its emergence has ushered in important strategic opportunities for the development of the digital economy. The development of digital economic industries is China's economic development strategy and an important force in driving the realization of common prosperity in the new era[1]. Data from the "Global Digital Economy White Paper (2022)" show that the scale of the global digital economy will account for as much as 45% of GDP in 2021. This also shows that the digital economy is increasingly becoming the main driving force for regional economic growth[2] and is promoting High-quality development[3], improving labor resource allocation efficiency[4], accelerating the transformation of China's foreign trade momentum[5] and other aspects play a key driving role. At the same time, digital rural construction is one of the practical paths for digital economy to empower rural revitalization[6], and has huge development space and potential.

The earliest scholars to combine digital economy with rural development found that the “digital divide” in rural areas is obvious, and the demand for informatization in rural areas is still relatively low[7]. The concept of “digital countryside” began in 2018 It has received widespread attention in academic circles and found that digital rural construction can help rural revitalization[8]. These two concepts seem irrelevant in the linear historical view from traditional agricultural society to postmodern information society, but in the 21st century China has cleverly connected them[9].

2. Research status

2.1. Related research on digital economy development evaluation index system

Measurement methods related to the digital economy are generally divided into two categories: one is the direct methods. Relevant domestic and foreign institutions have constructed digital economy measurement indicators from different angles[10][11]. These digital economy indicators can be directly used for measurement. Related research, for example, studies have used the digital economy index published by Tencent's "Internet +" digital economy index platform[12] and Peking University New Rural Development Research Institute and Ali Research Institute jointly conducted research on the indicators of the "County Digital Rural Index (2018)"[13].The second is the comparative method. Most scholars use the entropy method to measure and evaluate the development level of the digital economy[14][15], and some scholars use principal component analysis method to measure the digital economy[16].

2.2. Related research on factors influencing the digital economy

In terms of influencing factors of the digital economy, domestic and foreign scholars have conducted some research and analysis on them. On the one hand, since communication information technology is the foundation of electronic commerce，the development of the digital economy is closely related to the development of the ICT industry and information technology[17]. Therefore, Internet technology is an important symbol reflecting the development of the Internet economy[18]; broadband infrastructure construction is a necessary condition for the development of the digital economy[19] .On the other hand, the level of economic growth, government behavior, human capital, and other factors have a positive effect on the development level of the digital economy[20]. In this information age, the tertiary industry led by technological innovation and the level of culture and education also profoundly affect the development process of the digital economy[21][22].

2.3. Literature review

In summary, the direct and indirect methods are the main methods for measuring the level of digital economy development, and the factors affecting the digital economy mainly focus on the digital industry infrastructure and external environment. In the context of the digital age, as a typical representative of the western region, the Guangxi Zhuang Autonomous Region is facing the problem of uneven digital economic development in different counties. Therefore, this study studies the spatial correlation characteristics and influencing factors of digital rural construction within Guangxi region from a micro-level county perspective, and provides relevant policy suggestions for accelerating the development of the digital economy.

3. Research design

3.1. Overview of research objects

Guangxi Zhuang Autonomous Region is located in the south of China, and its mountains are karst landscapes and it has excellent water, air and marine environment. In recent years, Guangxi has attached great importance to the development of the digital economy. In August 2018, it held a Digital Guangxi Construction Conference and issued the "1+13" series of documents on the construction of Digital Guangxi. In accordance with the relevant requirements of the "China-ASEAN Information Port Construction Master Plan" , all The district 's digital economic development has further improved; in October 2020, the "Notice on Several Measures to Accelerate the Development of Guangxi's Digital Economy" document emphasized the need to implement the Party Central Committee's major decisions and arrangements on accelerating the construction of Digital China and implementing the national big data strategy, and actively promote Guangxi's digital economic industry has accelerated its development and promoted the construction of digital Guangxi.

3.2. Data sources

3.2.1. Interpreted variables

This study uses the "County Digital Rural Index (2020) Research Report" launched by the Peking University New Rural Development Institute in August 2022 for spatial feature analysis, and uses the 2018, 2019 and 2020 data published on the Ali Research Institute website. And the digital rural index of counties in 2018, 2019 and 2020 published on the website of Ali Research Institute was used as the level of rural digital development to conduct a study related to the influence factors. The county digital rural indicator system includes 4 first-level indicators, 12 second-level indicators and 33 specific indicators.

3.2.2. Explanatory variables

Table 1: Data of explanatory variables

Explanatory variables	Specific indicators	years
total economic basis	Gross regional product (100 million yuan)	2018, 2019, 2020
Industrial structure	Added value of tertiary industry (100 million yuan)	2018, 2019, 2020
	Proportion of crop sown area (%)	2018, 2019, 2020
Education level	Number of students in ordinary middle schools (person)	2018, 2019, 2020
governmental support	General public budget expenditure (100 million yuan)	2018, 2019, 2020
population size	Permanent population at the end of the year (10,000 people)	2018, 2019, 2020
per capita economic base	GDP per capita(yuan)	2018, 2019

This article combines existing research to analyze the specific conditions affecting the development of digital rural areas in Guangxi from five aspects: economic foundation, industrial structure, education level, government support and population size. Since the per capita GDP of some counties in Guangxi has not been announced in 2020, in order to ensure the reliability of the research results, in this study, each specific data of 2018 and 2019 (including GDP per capita) were collected

to further test with the digital rural index of Guangxi counties in 2018 and 2019 respectively using spatial measurement. The specific indicators of influencing factors are shown in Table 1. Except for the proportion of crop sown area, all other data are logarithmic. The data used in this article come from the "China County Statistical Yearbook", "Guangxi Statistical Yearbook", statistical bulletins on the official websites of county and district people's government offices, statistical yearbooks on the official websites of Guangxi prefecture-level municipal statistics bureaus, and the wind database.

4. Empirical research

4.1. Spatial correlation characteristics of Guangxi digital countryside

4.1.1. Global spatial autocorrelation

This paper uses the global spatial autocorrelation method to analyze the spatial correlation characteristics of the digital rural development level for the entire region. Using ARCGIS software to calculate the Moran's I value of the total index of digital rural areas in Guangxi counties is 0.226, and the critical value for the Z score greater than the 99% confidence level is 3.348, indicating that the possibility of randomly generating this cluster is less than 1 %, which is the development level of digital rural areas in Guangxi counties. That is, there is a significant spatial positive autocorrelation in the development level of digital villages in Guangxi counties, which indicates that the development of digital villages in individual counties is closely related to the surrounding areas, and manifests itself as a spatial aggregation feature.

4.1.2. Local spatial autocorrelation

In order to further analyze the local spatial correlation characteristics of digital rural development in Guangxi counties, clustering and outlier analysis in ARCGIS software were used to obtain the LISA agglomeration situation (shown in Table 2). First of all, Guangxi’s digital economy has obvious aggregation characteristics. There are 9 HH districts. These areas have their own geographical advantages and have a radiating effect on their surroundings. They play a positive driving role, making the region form a digital countryside. There are seven regions with significant low-low agglomeration forming lagging agglomerations. Secondly, there are five spatial anomalies (four HL zones and one LH zone). Such results indicate that the digital village index has a spatial siphoning effect, with high value zones plundering the resources of adjoining area to a certain extent, leading to a scarcity of resources in the surrounding areas.

Table 2: Digital rural index LISA agglomeration situation

Aggregation type	Number of regions	area name
H-H	9	Xingning County, Jiangnan District, Binyang County, Yongning District, Xixiangtang District, Yanshan District, Bama Yao Autonomous County, Beiliu City, Luchuan County
L-L	7	Xilin County, Longlin Autonomous County, Tianlin County, Leye County, Lingyun County, Tian'e County, Nandan County
H-L	4	Fengshan County, Youjiang District, Tiandong County, Dahua Yao Autonomous County
L-H	1	Fumian District

4.2. Analysis of influencing factors

4.2.1. Model selection

In this study, Queen first order spatial weights were constructed using Geoda software to do OLS regression, Lagrange multiplier test and robustness test. According to the results, Moran's I (error) p value is 0.002<5%, indicating that the model has spatial dependence, while LM (lag) p value is 0.000, LM (error) p value is 0.010, and the Lagrange multiplier test was significant for both. The result of the robustness statistic test shows that the Robust LM (lag) p value is 0.001, passing the robustness test, while the Robust LM (error) p value does not reach the significance level, so it is appropriate to choose SLM model for this study. The formula is as follows:

$$Y = \rho WY + X\beta + \varepsilon, \varepsilon \sim N[0, \sigma^2 I] \quad (1)$$

In the formula, Y is the matrix of interpreted variables, X is the matrix of explanatory variables, ρwhich is the spatial effect coefficient, and W represents the spatial matrix, which β is the parameter vector and ε is the error disturbance term.

4.2.2. Regression results

Run the SLM model according to the Geoda software. The regression results of the SLM model are shown in Table 3 for 2020, $R^2$with a value of 0.531, indicating that the model has a good fitting effect. According to the results, the region's total economic base (gross regional product) and population size have a negative effect on the development of digital rural areas in Guangxi counties. The development of primary and tertiary industries, education level and government support have a significant positive impact on digital rural development.

Table 3: Empirical results of factors influencing the development level of digital rural areas in Guangxi counties

Specific indicators	variable	2018		2019		2020	
		coefficient	p-value	coefficient	p-value	coefficient	p-value
GDP	lnx1	-0.222	0.001	- 0.321	0.000	-0.596	0.015
Added value of tertiary industry	lnx2	0.132	0.052	0.283	0.000	0.375	0.108
Proportion of crop sown area	x3	0.413	0.008	0.269	0.007	1.463	0.031
Number of students in ordinary middle schools	lnx4	0.261	0.000	0.200	0.000	0.746	0.000
General public budget expenditure	lnx5	0.008	0.800	- 0.040	0.009	0.345	0.237
Year-end resident population	lnx6	-0.205	0.038	- 0.094	0.315	-0.908	0.022
GDP per capita	lnx7	0.235	0.000	0.271	0.000	/	/
\	CONSTANT	0.034	0.170	0.039	0.057	-2.347	0.055

4.2.3. Further inspection

Further tests are done by running spatial regressions for each digital village data in 2018 and 2019 and the added influence of per capita economic base. In this paper, the test found that the data are also applicable to the SLM model, according to the regression results (as shown in Table 3 for 2018 and 2019): the regression results for the three years are more or less the same, but the government support and economic base appear to be different.

In terms of government support, General public budget expenditures appeared to present a non-significant positive boost and a significant negative effect on digital villages in the three years tested, which suggests that the situation of the impact of government support on digital villages is unclear, which is consistent with existing research. In economic research, it is generally believed that the greater the proportion of local government fiscal expenditures, the higher the possibility of distortion in the market mechanism. For example, for the eastern region of China, the positive contribution of the government budget to the level of digital economy development in that region is not significant[23].

In terms of economic foundation, the adoption of the results shows that GDP per capita is a significant contributor to the development of digital villages, while the aggregate economic base is significantly negative. Is this contradictory? This empirical result is analyzed using current research literature. On the one hand, GDP per capita is an important indicator of the level of economic and social development of a region, and the development of the digital economy is inevitably constrained by the level of economic development of the study unit[24]. On the other hand, empirical evidence from existing literature shows that the spillover effect of economic growth level on the digital economy is negative[20], which will also lead in part to testing the negative correlation between gross regional product and the digital countryside presented in spatial lag models.

5. Conclusions and suggestions

5.1. Main conclusions

The development level of digital villages in Guangxi counties shows spatial positive correlation in space, with significant high-value agglomeration effect and low-value agglomeration effect and spatial anomalies, indicating that the development of digital villages is closely related to the surrounding areas. In the study of influencing factors, the per capita economic base, the development status of primary and tertiary industries, and the education level have a positive influence on the development of digital villages in Guangxi counties; the population size has a negative influence; and the influence of government support is uncertain.

5.2. Suggestions

Exploring the circumstances affecting the level of development of digital villages based on the characteristics of the spatial correlation of the level of development of digital villages and the five influencing aspects leads to the following insights:

(1) Local governments should focus on regional co-ordination of digital village construction. They should improve the radiation and driving capacity of areas with a high level of digital village construction, strengthen exchanges and cooperation between weak areas and surrounding areas with advantages, and promote a more balanced construction of digital villages.

(2) Local governments need to increase the per capita economy of the region and improve the living conditions of users in order to increase the demand for digital products; the government should improve the strength and precision of the support of the funds and policies for the construction of digital villages, and it can reasonably set up a unified budgetary expenditure structure with a precise proportion of inputs, so as to prevent the squeezing of funds; Accelerated digitization of agriculture and rural areas in villages, and to improve the development of the tertiary industry in the countryside; and the education sector should make efforts to improve the quality of education, especially in areas where the development of the digital economy is weak.

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