

# Research on the Impact of Digital Economy on the High Quality Development of Guangxi Province's Economy

Lin Xinyu

School of Economics and Management, Guangxi Normal University, Guilin, China  
lxylxy20231221@163.com

**Abstract:** This paper firstly is based on the data of twelve prefecture-level cities in Guangxi Province from 2011 to 2021, it constructs the evaluation index system of digital economy and economic high quality development respectively, and uses entropy weight TOPSIS method to deal with it, and uses the random effect model to explore the impact of digital economy on the development of economic high quality in Guangxi Province. The results show that: ① The development of digital economy significantly and positively affects the quality of economic development in Guangxi Province, and the research results can be proved to be reliable by the robustness test and endogeneity test. ② Sub-regionally: there are differences in the level of digital economy and economic high-quality development among cities, which are manifested in the significant positive impact of digital economy on the economic high-quality development of Beibu Gulf Economic Zone and Xijiang Economic Belt, and the negative impact on the resource-rich areas in western Guangxi. ③The sub-dimension regression results show that the digital economy significantly and positively affects innovation, coordination, and shared development, while the effect on openness and green development is not significant. Finally, based on the conclusions of the study, policy recommendations are made on the path to achieve high-quality economic development driven by the digital economy.

**Keywords:** digital economy; high-quality economic development; Guangxi

## 1. Introduction

With the in-depth development of reform and opening up, how to achieve high-quality economic development is a major issue that needs to be faced now and in the future. The focus of achieving high-quality economic development lies in how to grow economic momentum and improve the quality of economic development. In this context, the rapid development of the digital economy has opened up a practical path for China to meet new challenges and solve new problems.

In recent years, with its unique geographical advantages and policy support, Guangxi's digital economy has shown a relatively strong momentum of development. According to statistics, the scale of Guangxi's digital economy in 2022 has exceeded 930 billion yuan, accounting for as much as 35.5 percent of GDP, and the digital economy has become an important engine of economic growth in Guangxi. Therefore, it is of great practical significance to study how the digital economy can promote the high-quality development of the economy.

## 2. Design of empirical research on the impact of digital economy on economic high-quality development in Guangxi Province

### 2.1. Empirical modelling

In this paper, regarding the direct impact of digital economy on the high-quality development of the economy, the relationship between digital economy and high-quality economic development is tested on the basis of controlling the industrial structure, the level of economic development, the level of financial development, the level of human capital, and is used as the benchmark regression results. Referring to the research of Zhao Tao et al. (2020), this paper sets the following research model<sup>[1]</sup>:

$$Aqua_{it} = \alpha + \beta_1 Digit_{it} + \beta_i Controls + \mu_i + \eta_t + \epsilon_{it}$$

where  $i$  is the sample region,  $t$  is time,  $A_{it}$  is the level of high-quality economic development of the dependent variable,  $\alpha$  is a constant term,  $\beta_1$  and  $\beta_i$  are regression coefficients of the independent and control variables,  $Digit_{it}$  is the level of development of the digital economy of the independent variable,  $\mu_i$  is the control for the individual fixed effect,  $\eta_t$  is the control for the time fixed effect, and  $\varepsilon_{it}$  is the error term.

## 2.2. Research hypothesis

High-quality economic development is not just an increase in the rate of economic growth, but also an improvement in the quality of economic growth. Among them, innovation is the first driving force for high-quality economic development, coordination is an endogenous feature of high-quality economic development, green is a universal form of high-quality economic development, and openness is a necessary path for high-quality economic development. The digital economy will improve the quality of regional economic development in all aspects from the above five levels. Based on the above analysis, this paper empirically tests the relationship between high-quality economic development in Guangxi Province and digital economy, and puts forward the following assumptions:

H: Digital economy development significantly and positively affects the quality of economic development.

## 2.3. Selection of indicator variables and data sources

### 2.3.1. Explained variables

Economic development reflects the comprehensive strength of the region, so if you want to achieve high-quality economic development in Guangxi Province, you should not only consider expanding the economic scale but also pay attention to improving the quality of economic development. This paper refers to the research of Liu Jia et al. (2021), takes the five new development concepts as the core, and selects the representative relevant indicators to construct the evaluation index system of high-quality economic development<sup>[2]</sup>. The data for constructing the indicator system come from the 2011-2021 China Regional Statistical Yearbook and CNDRS, and the specific indicators are shown in Table 1.

Finally, the comprehensive score of economic high-quality development calculated based on the entropy value method is regarded as an explanatory variable introduced into the model.

Table 1: Weights of indicators related to high-quality economic development

Level 1 indicators	Secondary indicators	Tertiary indicators	weights
Innovative development	investment in science and education	Science and technology inputs/financial expenditures	0.054
		Educational inputs/fiscal expenditures	0.057
	Patent level	Number of inventions filed	0.044
Co-ordinated development	Financial development	Balance of financial deposits/balance of financial loans	0.057
	people's livelihood	Completion of investment in non-real estate development/total investment in fixed assets	0.058
	industrial structure	Percentage of tertiary sector	0.056
open development	Overview of foreign investment	Use of foreign capital	0.058
	Overview of Foreign Enterprises	Value of output of foreign-owned enterprises	0.056
		Number of foreign-owned enterprises	0.051
Green development	three wastes emission	Wastewater discharge/industrial output	0.058
		so2 emissions/industrial output	0.058
		Dust emissions/industrial output	0.058
	sewage treatment	Comprehensive utilisation rate of general industrial solid waste	0.057
		Centralised treatment rate of sewage treatment plants	0.057
Shared development	social welfare	Wages of employed workers	0.054
	consumption level	Consumption of social retail goods/gdp	0.054
	Government burden	Fiscal revenues/expenditures	0.055

### 2.3.2. Core explanatory variables

This paper analyses the actual situation of Guangxi Province and its own characteristics, as well as the availability of relevant data, and draws on the method of Zhao Tao et al. (2020) to measure the comprehensive development level of the digital economy in terms of both Internet development and digital financial inclusion<sup>[1]</sup>. The data for constructing the index system come from the 2011-2021 China Regional Statistical Yearbook, and the digital financial inclusion index comes from the Digital Finance Research Centre of Peking University, and the specific indicators are shown in Table 2.

Finally, the comprehensive score of digital economy calculated based on the entropy value method is regarded as an explanatory variable introduced into the model.

Table 2: Weights of indicators related to the digital economy

Level 1 indicators	Secondary indicators	weights
digital economy	International Internet users per 100 population	0.200
	Percentage of employees in the information transmission, computer services and software industry	0.201
	Total telecommunication services per capita	0.201
	Mobile phone subscribers per 100 population	0.199
	Digital Inclusive Finance Index	0.197

### 2.3.3. Control variables

In order to more comprehensively analyse the impact of the digital economy on the high-quality development of the economy, this paper sets other factors that may have an impact on the high-quality development of the economy as control variables, with reference to the research results of Zhang Yunping et al. (2021), and sets the following control variables, which are defined as follows: the level of upgrading of the industrial structure (ISH) is measured in terms of the proportion of the added value of the tertiary industry to the GDP, which is specifically expressed as the optimisation and upgrading of the industrial structure (ISH) is measured by the proportion of added value of the tertiary industry in GDP, which is specifically expressed as the optimisation and upgrading of the industrial structure, so as to improve the competitiveness and sustainability of the economy; the level of economic development (GDPPC) is measured by the per capita gross domestic product (GDP), because the per capita GDP can reflect the per capita output of the region, and the larger the per capita GDP is, the better the production efficiency of the region is to a certain degree, and the higher the level of economic development; the level of financial development (FD) is measured by the total deposit and loan amount of RMB by financial institutions as a percentage of GDP at the end of the year. The level of financial development (FD) is measured by the total amount of RMB deposits and loans of financial institutions as a proportion of GDP at the end of the year, which largely determines the speed of economic growth, the quality of the job market, and the fairness of income distribution; the level of human capital (HCL), which mainly manifests itself in the improvement of the quantity and quality of the labour force, can be measured by the number of students enrolled in undergraduate and tertiary institutions in relation to the average annual population, and the improvement of the quality of the talent team can boost the high quality of the economy development<sup>[3]</sup>.

## 3. Empirical Analysis of the Impact of Digital Economy on Economic High Quality Development in Guangxi Province

In order to verify that H: digital economic development significantly and positively affects the quality of economic development in Guangxi Province, this paper runs Stata15.0 software, judges the model that should be selected according to the results of F test, LM test and Hausman test, and finally selects the random effect model to carry out the baseline regression analysis and heterogeneity analysis, and adopts the robustness test, the endogeneity test and the subdimensional test to verify the baseline regression analysis and the reliability of the results. The reliability of the results was verified using robustness test, endogeneity test and dimensionality test.

### 3.1. Baseline regression analysis

In this paper, using Stata 15.0 software, the random effects model was selected for the baseline regression analysis and the regression results obtained are included in Table 3.

According to the results of the significance test of the regression coefficient, it can be seen that the

regression coefficient of the independent variable digital economic development level is 0.105, i.e., for every 1 unit increase in the level of digital economic development, the high-quality development of the economy is increased by 0.105 units, and the p-value of this regression coefficient is  $0.000 < 0.05$ , which achieves the significance level of 1 per cent. Therefore, it can be initially considered that the level of digital economic development of the independent variable can significantly and positively affect the level of high-quality economic development of the dependent variable, and H is verified.

This paper adds control variables on the basis of the regression analysis model (1): the level of industrial structure upgrading, the level of economic development, the level of financial development, and the level of human capital. The regression coefficient of the independent variable digital economic development level after the addition is 0.034 and reaches the significance level of 10%, so it is considered that the independent variable digital economic development level can significantly affect the dependent variable high-quality economic development level.

Specifically, the regression coefficient of the level of industrial structure upgrading is not significant, which may be due to the fact that in the process of industrial structure upgrading, Guangxi continuously promotes the promotion of the status of the service industry, which may lead to the phenomenon of "de-industrialisation", resulting in the reduction of jobs, uneven distribution of income and other problems, and the excessive inclination to the development of the service industry may also lead to the mismatch of resources, which makes some potential industries not receive sufficient development support. The over-orientation towards the development of service industry may also lead to resource mismatch, making some potential industries not receive sufficient development support. These problems limit the effect of industrial structure upgrading and make it difficult to achieve high-quality economic development. The coefficient of the level of economic development is significantly positive, indicating that the increase in per capita GDP helps to raise the level of residents' income and expand consumption demand, thus promoting high-quality economic development. The coefficient of the level of financial development is significantly positive, indicating that financial development can provide more financing channels and financial support for high-quality economic development, which also indicates that Guangxi needs to pay more attention to and support financial development. In addition, the result of human capital level is not significant, guessing that this aspect is due to the fact that human capital in Guangxi is mainly concentrated in large areas such as Nanning and Liuzhou, while the level of human capital in small areas is low. This uneven distribution makes it difficult to give full play to the contribution of human capital to high-quality economic development.

Table 3: Benchmark regression and endogeneity test results

variant	return to baseline		endogeneity test	
	(1)Aqua	(2)Aqua	(3)Aqua	(4)Aqua
Digit	0.105*** (0.012)	0.034* (0.018)	0.085*** (0.012)	0.035** (0.016)
ISH		-0.108 (0.080)		-0.114 (0.075)
GDPPC		0.055*** (0.014)		0.039*** (0.013)
FD		0.040*** (0.014)		0.037*** (0.013)
HCL		-0.025 (0.260)		0.092 (0.265)
_cons	0.502*** (0.022)	-0.080 (0.137)	0.519*** (0.021)	0.107 (0.129)
N	154	154	140	140
Area Fixed	containment	containment	containment	containment
Year fixed	containment	containment	containment	containment

Remarks: \*, \*\*, \*\*\* denote significance at the 10 per cent, 5 per cent and 1 per cent significance levels, respectively.

### 3.2. Endogeneity test

In order to eliminate the endogeneity problem caused by the reverse causality of "the better the economic development, the better the development of the digital economy" as far as possible, this paper refers to the study of Lu Zhaoyang (2022), and chooses the digital economy lagged by one period as an instrumental variable to deal with the endogeneity<sup>[4]</sup>. According to the results of columns (3) and (4) in Table 4, the regression coefficients of the level of digital economic development are significantly

positive without considering the control variables and considering the control variables, and the coefficient value of column (4) in Table 4 is larger compared with that of column (2), so it can be assumed that the level of development of the digital economy, which is the independent variable, can significantly and positively affect the level of high-quality economic development, which is once again verified.

### 3.3. Robustness tests

In order to reduce the error and at the same time to ensure the robustness of the research findings, this paper has carried out the robustness test through three ways way. The first is to replace the explanatory variables. Given that the development of the digital economy stems from the progress of the Internet, the instrumental variable can thus be selected from the development history of China's Internet access technology. The number of Internet broadband access users is the cornerstone for the digital economy to thrive, and the only way to support a large amount of data transmission, processing and storage is to have high-speed and stable network access. At the same time, drawing on international experience also reveals that the development of the digital economy is often inseparable from network penetration, for example, the number of Internet broadband access users in the United States, the number one country in the global digital economy, accounts for more than 70% of the total population. Therefore, referring to the research ideas of Huang Qunhui et al. (2019), this paper replaces the explanatory variable digital economy development level with the number of Internet broadband access users (BU) and reruns the regression, and the final results are displayed in column (1) of Table 4. Second, replace the explanatory variables. GDP per capita can reflect the level of economic development, production efficiency, and economic structure of a country or region, and is an important element reflecting the high-quality development of the economy. Therefore, this study draws on the method of Han Zhen (2023), replacing the explanatory variable of the level of high-quality development of the economy with GDP per capita (GDPPC) to re-regress<sup>[5]</sup>, and the final results are displayed in column (2) of Table 5. Third, the reduced-tail regression. This paper draws on the research method of Tongtong Zhao (2023) to shrink the tails of the explanatory variables to eliminate the effects of outliers, and the results are displayed in column (3) of Table 4. The results of the study show that the regression results are basically consistent with the previous paper, which proves the robustness of the findings.

Table 4: Robustness test

	(1)Aqua	(2)GDPPC	(2)Aqua
BU	0.048** (0.022)		
Digit		0.604*** (0.095)	0.034* (0.018)
ISH	-0.146* (0.083)	1.608*** (0.450)	-0.108 (0.080)
GDPPC	0.044*** (0.016)	0.000 (0.000)	0.055*** (0.014)
FD	0.038*** (0.014)	-0.181** (0.080)	0.040*** (0.014)
HCL	-0.009 (0.263)	4.509*** (1.510)	-0.025 (0.260)
_cons	-0.012 (0.146)	9.769*** (0.121)	-0.080 (0.137)
N	154	154	154
Area Fixed	containment	containment	containment
Year fixed	containment	containment	containment

Remarks: \*, \*\*, \*\*\* denote significance at the 10 per cent, 5 per cent and 1 per cent significance levels, respectively.

### 3.4. Heterogeneity analysis

The development of the prefecture-level cities in Guangxi province presents a more obvious imbalance, in which the digital economy and the development of economic high quality are more obvious heterogeneity characteristics, so it is necessary to carry out the research on the impact of the digital economy on the development of economic high quality for the regional heterogeneity test. According to the "State Council on further promoting the economic and social development of Guangxi

a number of opinions", according to the city's geographic location, resource endowment and other factors to divide Guangxi into the Beibu Gulf Economic Zone, the Xijiang River Economic Belt and Guixi resource-rich area of three types of areas, constituting the overall layout of the regional development of the whole of Guangxi, the purpose is to give full play to the economic advantages of the prefectural-level municipalities to optimise the allocation of resources, and to enhance the synergistic effect of regional development. Therefore, this paper divides the fourteen prefecture-level cities of Guangxi province under study into the Beibu Gulf Economic Zone (Nanning, Beihai, Fangchenggang, Qinzhou), the resource-rich area of western Gui (Baise, Hechi, Chongzuo), and the Xijiang Economic Belt (Liuzhou, Guilin, Wuzhou, Guigang, Yulin, Hezhou, and Laibin) to be examined respectively, and the results of the empirical evidence are shown in Table 6. From Table 5, we find that: the impact of the digital economy on the economic development of the Beibu Gulf Economic Zone, the economic belt of the Western River is significantly positive. The impact of digital economy on the high quality development of Beibu Gulf Economic Zone and Xijiang Economic Belt is significantly positive, while the impact on the resource-rich area of West Gui is significantly negative, which may be attributed to the following reasons: Firstly, Beibu Gulf Economic Zone is located in the southern coastal area of China, which can rely on its own location advantages to continuously strengthen cooperation with ASEAN countries in the field of digital economy, and provide a new impetus for the development of digital economy. And Nanning, as the capital area of the province, has a strong industrial base and scientific and technological strength, which can play a radiation-driven role to make the digital economy in the region develop faster, develop at a higher level, and drive the high-quality development of the economy is also more significant. Secondly, Guangxi's Xijiang Economic Belt has a better industrial foundation, and its leading region Liuzhou City has a strong manufacturing base, covering automobile manufacturing, machinery manufacturing and other fields. The digital transformation needs of these industries are large, providing a broad market space for the development of digital economy. At the same time, the number of colleges and universities in the Xijiang Economic Belt is large, including Guangxi Normal University, Guilin University of Electronic Science and Technology and other well-known colleges and universities, these colleges and universities of electronic information, computer science and other specialties are more prominent for the development of the digital economy provides a large number of excellent talents. The wave of digital economy keeps moving forward, resulting in its contribution to the high-quality development of the economy becoming more and more prominent. Thirdly, the development of digital economy has a significant negative impact on the resource-rich areas in western Gui, which may be the result of the digital divide. As an underdeveloped region, the resource-rich areas in western Gui have relatively low levels of digital infrastructure and technology, and the digital divide is more serious, which makes local enterprises face greater difficulties in the process of digital transformation, and restricts the positive effect of the digital economy on the high-quality development of the economy.

Table 5: Results of heterogeneity analysis

	(2) Beibu Gulf Economic Zone (economic region including Beijing, Tianjin, Hebei, Liaoning and Shandong)	(3) Guanxi resource-rich area	(4) Xijiang Economic Belt
Digit	0.091*** (0.035)	-0.098* (0.052)	0.055** (0.022)
ISH	0.129 (0.102)	0.492*** (0.148)	-0.201 (0.143)
GDPPC	-0.076*** (0.014)	0.144*** (0.035)	0.048** (0.019)
FD	-0.020** (0.008)	-0.008 (0.033)	0.035 (0.031)
HCL	1.919*** (0.238)	-0.248 (0.590)	0.363 (0.405)
_cons	1.285*** (0.153)	-1.138*** (0.357)	0.051 (0.182)
N	44	33	77
Area Fixed	containment	containment	containment
Year fixed	containment	containment	containment

Remarks: \*, \*\*, \*\*\* denote significance at the 10 per cent, 5 per cent and 1 per cent significance levels, respectively.

### 3.5. Sub-dimensional test of the digital economy for high-quality economic development

This paper constructs the evaluation system of high-quality economic development based on the five new development concepts, and in order to further study the mechanism of the digital economy affecting high-quality economic development, regression analyses are carried out with the five sub-indicators of innovative development, open development, coordinated development, green development and shared development as the dependent variables, and the results are shown in Table 6.

Table 6: Regression results based on five dimensions of quality development

	(1) Inno	(2) Open	(3) Coor	(4) Green	(5) Incl
Digit	0.022*** (0.005)	-0.001 (0.007)	0.011* (0.006)	0.006 (0.013)	0.019*** (0.005)

Remarks: \*, \*\*, \*\*\* denote significance at the 10 per cent, 5 per cent and 1 per cent level of significance, respectively.

From Table 6, we can get that: the digital economy of Guangxi has passed the significance test for the development of innovation, coordination and sharing, among which the performance is most significant for the development of innovation. The reason why the open development is not significant may be that Guangxi faces a series of dilemmas in the process of open development, such as the low level of connectivity and the single structure of foreign trade. Although Guangxi has built a number of highways and railways, due to the complex terrain, the transport network is not perfect, and the transport cost is high, which restricts the depth and breadth of Guangxi's opening up to the outside world. And Guangxi is overly dependent on resource development and primary product exports, the development of high-tech industries and modern service industry is lagging behind, the industrial chain is short, and the added value of products is low. These dilemmas make the digital economy constrain the positive effect on open development. The lack of significant performance in green development may be due to the fact that Guangxi's economic growth still relies on traditional resource-based industries, such as coal and non-ferrous metals, which have a high energy consumption intensity and serious environmental pollution problems, posing a great challenge to green development. Moreover, Guangxi's weak R&D capacity in green technology, insufficient application of advanced technology and slow development of new energy industry can hardly support the effective promotion of green development, so the digital economy has not been able to effectively promote high-quality development through green development for the time being.

## 4. Conclusions and policy recommendations

Based on the theoretical analysis of the mechanism of digital economy empowering economic high-quality development, this study selects the panel data of twelve prefecture-level cities in Guangxi Province from 2011 to 2021, and examines the role of digital economy on economic high-quality development through empirical analysis. The conclusions are as follows:

First, the development of digital economy significantly and positively affects the quality of economic development in Guangxi Province, and the research results can be proved to be reliable by the robustness test and endogeneity test. Secondly, subregionally: there are differences in the level of digital economy and economic high-quality development between cities, which is manifested in the significant positive impact of digital economy on the high-quality development of economy in the Beibu Gulf Economic Zone and the Xijiang Economic Belt, while the impact on the resource-rich areas in western Guangxi is negative. Thirdly, the results of the sub-dimension regression show that: the digital economy of Guangxi Province passed the significance test for the development of innovation, coordination and sharing, in which the performance on innovation development is most significant, while the role of openness and green development is not significant.

Based on the above conclusions, this paper puts forward the following policy recommendations on the path to realising high-quality economic development driven by the digital economy:

### 4.1. Formulating a digital economy development strategy tailored to local conditions and strengthening coordinated development in Guangxi

Guangxi needs to formulate a digital economy development strategy according to local conditions, strengthen regional coordinated development, and stimulate the positive role of the digital economy in

resource-rich areas in western Gui for high-quality economic development. Compared with the Beibu Gulf Economic Zone and the Xijiang Economic Belt, the resource-rich area in western Guangxi has constraints such as a weak economic foundation, lagging scientific and technological development, unsatisfactory education, and insufficient transport facilities, but this doesn't mean that the western part of the region doesn't have potentials and advantages in the development of the digital economy. In fact, West Gui region can rely on its rich resource advantages to accelerate the digital transformation and upgrading of traditional industries, and better stimulate the positive role of the digital economy in the high-quality development of the economy.

#### **4.2. Commitment to building a "digital silk road" and promoting open development in Guangxi**

As the frontier and window of China's openness and cooperation towards ASEAN, Guangxi should be committed to building a "Digital Silk Road" open cooperation highland facing ASEAN, promoting open development with ASEAN countries in the fields of economy and trade, science and technology, education, culture and so on, so as to better stimulate the positive role of the digital economy in the high-quality development of the economy. First of all, Guangxi can give full play to its own location advantages and take Nanning as the centre to strengthen the information infrastructure construction and interconnection with ASEAN countries. The Digital Silk Road can become a true 'information highway' connecting China and ASEAN by constructing cross-border fibre optic cables, satellite communication systems, international Internet data dedicated channels, and other information channels. This will improve the speed and quality of information transmission while reducing communication costs. Secondly, Guangxi should actively promote cooperation and development in the digital field. In the field of digital economy, it should share its experience, resources and technology with ASEAN countries, and jointly cultivate new economic growth points to achieve mutual benefits and win-win results. In addition, Guangxi needs to work on improving the level of digital trade with ASEAN countries. Through e-commerce, cross-border payments and other means, trade barriers will be lowered and trade facilitation will be improved.

#### **4.3. Promoting the integration of the digital economy and green development to achieve green development in Guangxi**

Guangxi should grasp the opportunity of digital economy development, closely integrate green development with digital economy, inject new power into the green development of Guangxi, and further stimulate the positive role of digital economy in the development of high quality economy. First, the government should strengthen the environmental protection supervision of enterprises, implement a strict environmental protection system for seriously polluting enterprises, and impose necessary penalties, rectification and even closure on enterprises whose environmental protection does not meet the standards, so as to force enterprises to move towards the road of green development. At the same time, the government also needs to increase investment to support the research and development of green technology. By establishing special funds, introducing tax incentives, and other means, key support is given to research and develop new energy, energy-saving, and environmental protection technologies. This encourages enterprises to increase investment in green technology research and development. Secondly, enterprises need to take the initiative to embrace digital transformation and enhance the efficiency of resource utilisation. With the application of big data, cloud computing and other technologies, enterprises can more accurately grasp the consumption of resources in the production process, so as to take targeted measures to reduce energy consumption and emissions. In addition, digital transformation can also help enterprises optimise production processes, reduce waste and further improve resource efficiency. Thirdly, the public should also establish a strong awareness of energy conservation and environmental protection, and actively participate in green consumption and low-carbon life from all aspects of life, so as to jointly contribute to the development of a green and low-carbon digital economy.

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