

Research On the Impact and Mechanism of Digital Inclusive Finance on Regional Carbon Emissions

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Abstract. Digital inclusive finance will be a crucial engine to support high-quality and sustainable economic development and achieve carbon emission reduction in the context of achieving carbon peak and carbon neutrality goals. Based on China's provincial panel data from 2011 to 2020, this essay focuses on the impact and heterogeneity of digital inclusive finance on regional carbon emissions. It explores the role of digital inclusive finance in promoting green carbon reduction through industrial structure upgrading and energy utilization efficiency. The results show a significant negative connection between digital inclusive finance and regional carbon emissions, manifesting that digital inclusive finance has made a difference in reducing emissions. Digital inclusive finance can achieve the effect of carbon emission reduction by upgrading industrial structure and improving energy utilization efficiency. The inhibitory effect of digital inclusive finance on carbon emissions shows a strong carbon emission reduction effect in the eastern and western regions. Compared to underdeveloped areas in financial development, the inhibitory effect of digital inclusive finance on regional carbon emissions is more obvious.

Keywords: digital inclusive finance; regional carbon emissions; energy utilization efficiency; industrial structure upgrading; heterogeneity.

1. Introduction

Scientific studies have shown that greenhouse gases such as carbon dioxide emitted by human beings in industrial production and daily life are an important cause of global warming, and climate change will directly affect the survival and development of human beings. From the perspective of realizing human and nature's harmonious intergrowth, Chinese modernization is the modernization of green development, and carbon emission reduction is an essential part of green development. Therefore, accelerating the reduction of carbon emissions and redressing the balance between economic development and environmental quality are crucial for achieving Chinese modernization, carbon peak and carbon neutrality. The study found that when carbon emissions exceed the danger point, the climate and ecosystem will undergo irreversible mutations, leading to various catastrophic consequences, which in turn threaten the living environment and economic development. Since China is in a critical period of high-quality economic transformation, in accordance with the 20th National Congress of the Communist Party of China reported that "promoting green and low-carbon economic development is the key path to achieving high-quality development", and steadily promoting the "dual carbon" work is the proper meaning of advancing the low-carbon economy. Ensuring stable economic growth to the greatest extent under the constraints of the process of carbon emission reduction has always been a major issue facing China's economy (Shouxi Li, Jiahao Zhang, 2023). Regarding China's domestic development, the traditional financial system has long-term structural imbalances and resource misallocation caused by insufficient financial supply, which largely restricts the development potential of emerging green industries. By lifting green total factor productivity, digital financial inclusion reduces total regional carbon emissions effectively (Li et al., 2023). Therefore, developing digital inclusive finance is conducive to resisting risks, actively responding to the challenges brought about by the "dual carbon" goal, and promoting high-quality economic evolution as well.

In comparison with the previous research, this essay mainly concentrates on the following contributions. Firstly, it enriches the study's range of how digital inclusive finance effectively

promotes sustainable development while giving full play to economic effects, revealing the positive influence of digital inclusive finance in promoting energy conservation, green low-carbon development, and emission reduction. Secondly, digital inclusive finance concerning the carbon reduction process through improving energy efficiency and upgrading industrial structure is empirically tested. Finally, the heterogeneity of digital inclusive finance on regional carbon emissions at the level of central, western, and eastern and financial development is discussed, which supplies an imperative decision-making reference and theoretical basis for achieving the "dual carbon" goal and realizing Chinese modernization as scheduled.

2. Theoretical Mechanism and Research Hypothesis

2.1. Digital inclusive finance makes a difference in regional carbon emissions directly.

Digital inclusive finance holds a "high multiplier" effect with its main characteristics of "data-driven", "technology-enabled" and "platform connectivity". The contrast to traditional finance, it breaks through the bounds of space and time, broadens the range of traditional financial services, and effectively reduces various costs such as risk identification, data processing, and traditional operations, greatly improving the availability of financial resources (Kan et al., 2023). Specifically, digital financial inclusion reduces the carbon emissions generated by most offline activities by guiding people to participate in online activities, simultaneously allowing medium-sized and small entrepreneurs with financing difficulties to acquire low-cost financial support, which not only saves the cost of search and time but also diminishes the carbon dioxide produced during the transaction. Regarding industrial emissions, digital finance can afford convenient financial assistance for relevant enterprises developing new technologies and products, improve the level of industrial modernization, enhance the role of capital factors in industrial transformation, and then promote industrial carbon emission reduction. Additionally, digital inclusive finance can also help reform the government management system, improve environmental governance capabilities, achieving regional carbon emission reduction (Huan Liu, 2023).

Digital financial inclusion can help reduce underserved areas' reliance on economic development in carbon-intensive industries. When providing services, financial institutions use digital platforms to assess and monitor the risks and returns of sustainable development projects to achieve green allocation of financial resources. Furthermore, the issue of information asymmetry and the imbalance of pricing power between the two parties is more common in the carbon trading market, and this situation will be alleviated to a certain extent in the macro environment where digital financial inclusion is effectively utilized. With the emergence of new services such as online payment, mobile banking, and e-commerce, digital inclusive finance equipped people with access to low-carbon products and services, promoting the popularization of low-carbon routine (Ding X et al., 2022). Based on the above, hypothesis 1 is put forward.

H1: Digital inclusive finance makes a restraining difference in regional carbon emissions.

2.2. The influence mechanism of digital inclusive finance on regional carbon emissions

Under the same situations, improving energy efficiency means that less energy is consumed per unit of GDP output, which urges carbon reduction (Mao et al., 2022). The essence of continuous improvement of energy efficiency comes from technological transformation and equipment renewal, and scientific and technological innovation activities are inseparable from the support of the economic system, especially the financial system, in turn, technological innovation plays an essential role in lifting energy efficiency in digital finance (Yang et al., 2023). Besides, digital financial inclusion, the outcome of industrial transformation, broadens the upper limit of energy efficiency modification, enhancing the economic system, and thus promoting carbon emission reduction (Zhou Yu et al., 2023). Meanwhile, digital inclusive finance efficiently boosts technological transformation and energy structure adjustment by helping to promote emerging technologies such as intelligence and greening, reducing the proportion of energy-intensive industries at low-cost attributes to significantly

improving energy efficiency. Promoting digital inclusive finance will reinforce improving energy efficiency leading to carbon emission reduction (Sun Jing, 2024). Based on the above, hypothesis 2 is put forward.

H2: Digital inclusive finance makes a difference in carbon emissions indirectly through energy efficiency.

The transformation of the industrial chain from low productivity to high productivity is inherently the upgrading industrial structure. Given the modern industrial structure, that is, a trend of transformation from the secondary and primary industries to the tertiary industry (Ruijuan Zhao et al., 2023). According to Mingxin Wang, Yiwei Wang et al. (2023), industrial transformation and upgrading request a large quantity of capital investment and resource adjustment, while digital inclusive finance provides enterprises with more flexible financing and payment methods. By leveraging technologies like the internet and mobile payments, companies can achieve financing and capital flow more efficiently, reducing the cost and risk of industry transformation. From the "Internet+" era to the current three-year action plan (2024-2026) of "Data Element ×", digital inclusive finance expands the service boundaries of modern finance and completes a leap in industrial structure, providing a new starting for green finance. On the one hand, the digital characteristics of digital inclusive finance trigger the learning effect of traditional industries, thereby promoting their transformation to digital industries, changing the resource consumption mode of traditional industries, reducing resource waste and promoting the low-carbon economy. On the other hand, the inclusive nature of financial services will also indirectly promote the upgrading of other industries, through the processing and use of massive data to invest funds in environmentally friendly industries with development potential to solve their financing difficulties and other problems, and then higher entrepreneurs' survival rate. Based on the above, hypothesis 3 is put forward.

H3: Digital inclusive finance indirectly affects carbon emissions by upgrading industrial structures.

3. Research Design

3.1. Model Construction

To test the influence of digital inclusive finance on regional carbon emissions, this essay first constructs a benchmark regression model as follows:

$$ten_{i,t} = \beta_0 + \beta_1 dig_{i,t} + \beta_2 Control_{i,t} + \rho_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

where i is the region and t is the year. $ten_{i,t}$ represents regional carbon emissions, $dig_{i,t}$ stands for the digital financial inclusion index, and $Control_{i,t}$ represents the controlled variable selected in this essay, including the degree of scientific and technological innovation represented by $Tech_{i,t}$; population density and urbanization represented by $Pop_{i,t}$, $Urb_{i,t}$; the level of ecological environment represented by $Eco_{i,t}$; the level of economic development represented by $GDP_{i,t}$; ρ_i represents a regional fixed effect, γ_t represents fixed time effect, $\varepsilon_{i,t}$ represents random perturbation.

To elaborate the mechanics of digital inclusive finance on carbon emissions, the mechanism modeling was constructed as followed:

$$ten_{i,t} = \alpha_0 + \alpha_1 dig_{i,t} + \mu Control_{i,t} + \rho_i + \gamma_t + \varepsilon_{i,t} \quad (2)$$

$$Medi_{i,t} = \beta_0 + \beta_1 dig_{i,t} + \mu Control_{i,t} + \rho_i + \gamma_t + \varepsilon_{i,t} \quad (3)$$

$$ten_{i,t} = \alpha_0 + \alpha_1 dig_{i,t} + \alpha_2 Medi_{i,t} + \mu Control_{i,t} + \rho_i + \gamma_t + \varepsilon_{i,t} \quad (4)$$

Among them, $Medi_{i,t}$ represents the level of the mechanism variables in province i in the t year and other control variables are consistent with the above. In the test procedure, first of all, the coefficient α_1 shows significance is the premise of the mechanism test, and its absolute value tends to be 0, second, something needs to be noted that the significance level of the $\beta_1, \alpha_1, \alpha_2$ and then

judge whether there is a complete mediation or partial mediation effect, if the non-significant is a complete mechanism, and the significant and absolute value tends to 0 is a partial mechanism, and finally the coefficient sign of $\beta_1 \times \alpha_2$ the same as α_1 are confirmed to the mediation effect is valid.

3.2. Variable Selection

The explanatory variable - regional carbon emissions (ten)

By drawing on previous research, according to the reference factor in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2019 Revision). In this essay, the annual carbon emissions of each province and city are calculated based on the following method:

$$ten_t = \sum_{k=1}^n ten_{tk} = \sum_{k=1}^n (\rho_{tk} \times \omega_k) \quad t, k=1, 2, \dots, n \quad (5)$$

Wherein, ten_t is the regional carbon emissions, $\sum_{k=1}^n ten_{tk}$ accounts for the total carbon emissions of the consumption of $k = n$ energy sources, ρ_{tk} stands for the consumption of the k th energy source, and ω_k represents the CO2 coefficient of the consumption of the k th energy source.

The core explanatory variable - digital inclusive finance (dig)

This essay uses the Digital Inclusive Finance Development Index was produced by the Digital Finance Research Center of Peking University and Ant Financial used to weigh the level of digital financial inclusion.

Mediation variables

(1) Industrial structure (du). The method of the gross value of tertiary industry/gross value of secondary industry is applied to calculate the degree of upgrading industrial structure.

(2) Energy efficiency (Eu). The total energy consumption/GDP method is used to measure energy efficiency.

Control variables

To eradicate endogeneity caused by the omission of variables, control variables are applied by referring to previous literature research. The technological innovation degree (Tech) is weighed by the number of effective invention patents, the population density (Pop) is measured by the number of people per unit of land area, urbanization degree (Urb) is weighed by the proportion of urban to the total population, ecological environment degree (Eco) is measured by the green coverage rate of built-up areas, and the level of economic development (GDP) is measured by the gross regional product.

Table. 1 Variable definitions

	Variable	Symbol	Definition
Explanatory Variables	Regional carbon emissions	ten	Energy Consumption * Carbon Emission Factor
Explain Variables	Digital financial inclusion	dig	Peking University Digital Inclusive Finance Index
Intermediary Variables	Industrial structure	du	Gross tertiary industry / Gross secondary industry value
	Energy efficiency	Eu	Total energy consumption/gross domestic product
Control Variables	The degree of scientific and technological innovation	Tech	Number of valid invention patents/pieces
	Population density	Pop	People/sq km
	Level of urbanization	Urb	Urbanization level, %
	Ecological environment level	Eco	Green coverage rate of built-up areas, %
	level of economic development	GDP	Gross Domestic Product (100 million yuan)

3.3. Data Description

The availability of data was taken into consideration for each variable, 30 provincial panel data from 2011 to 2020 in China were selected as samples for the empirical study. The data are obtained ranging from the China Statistical Yearbook, the Peking University Digital Financial Inclusion Index, as well as the Office of the National Climate Change Countermeasures Coordination Group, and the Energy Research Institute of the National Development and Reform Commission, covering the period from 2011 to 2020. Among them, the variables of carbon emission D, scientific and technological innovation, ecological environment level, population density, industrial structure and energy consumption intensity were logarithmically processed, and the missing values of some variables in individual cities and years were filled in by moving average means and linear interpolation means.

Table. 2 Descriptive statistical of each variable

Variable	Sample	Mean	Std	Minimum	Maximum
ten	300	10.1633	0.8695	7.8470	11.7246
dig	300	217.2461	96.9682	18.3300	431.9300
Tech	300	8.7047	1.8924	2.4849	12.9843
Eco	300	3.6741	0.0921	3.3286	3.8939
Pop	300	5.4646	1.2876	2.0669	8.2751
Urb	300	0.5866	0.1222	0.3496	0.8960
du	300	0.0948	0.4183	-0.6577	1.6671
Eu	300	0.6523	0.6402	-1.1435	2.0779
GDP	300	25558.3700	20493.8500	1670.4400	110760.9000
En	300	0.3301	0.7187	-2.0522	2.0172

According to the results of Table 2, the carbon emission (ten) is characterized by a huge standard deviation and a large gap in the minimum and maximum, indicating that there is an obvious deviation in regional carbon emissions. Digital Inclusive Finance (dig) and other control variables also have the characteristics of large standard deviation and huge minimum and maximum gaps. Hence a wide disparity exists in digital inclusive finance in various regions, which fully highlights uneven and insufficient development in various provinces.

4. Empirical Results and Discussions

4.1. Benchmark regression

This essay selects a fixed-effect model to prove the carbon emission reduction effect of digital inclusive finance. The specific results are illustrated in Table 3, which indicate that the effect coefficient is negative no matter whether the control variables are introduced, that is, there is a significant negative correlation in digital inclusive finance and regional carbon emissions. At the 1% level significantly, proving that digital inclusive finance effectively reduces carbon emissions, verifying the H1 that digital inclusive finance makes a difference in regional carbon emissions is inhibitory.

Table. 3 Baseline regression results

Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
dig	-0.0004** (-2.32)	-0.0016*** (-4.43)	-0.0013*** (-3.65)	-0.0013*** (-2.92)	-0.0012** (-2.35)	-0.0012** (-2.33)
Tech	-	0.1028*** (3.78)	0.1067*** (3.96)	0.1062*** (3.81)	0.1063*** (3.80)	0.1057*** (3.76)
Eco	-	-	-1.1824*** (-2.66)	-1.1851*** (-2.65)	-1.1238** (-2.29)	-1.1156** (-2.26)
GDP	-	-	-	-1.95e-07 (-0.07)	-1.66e-07 (-0.06)	-3.56e-07 (-0.12)
Urb	-	-	-	-	-0.2609 (-0.30)	-0.2700 (-0.45)
Pop	-	-	-	-		0.1238 (0.21)
Cons	10.2401*** (284.85)	9.6123*** (56.65)	13.8689*** (8.63)	13.8842*** (8.54)	13.7930*** (8.33)	13.1004*** (3.61)
Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes

Note: ***, **, and * are significant at 1%, 5%, and 10% confidence levels, respectively, and the values in () are T values, the same as below.

Moreover, in terms of the regression coefficients of the control variables, it serves to show that the ecological environment, the level of economic development, and the extent of urbanization show a negative relationship for carbon emissions, indicating that the improvement of the above variables can remarkably suppress the rise of carbon emissions. The regression coefficients of scientific and technological innovation and population density are positively related, suggesting that the growth of technological innovation and population density is not conducive to carbon emission reduction.

4.2. Robustness check

Table 4 displays the results of the robustness check by substituting the explanatory variables, and the robustness check is carried out by using the energy consumption intensity (En) instead of the regional carbon emission level, and the energy consumption intensity is measured by carbon emissions/GDP to verify the robustness of the previous conclusions.

Table. 4 Robustness check results

Variable	Model(1)	Model(2)
dig	-0.0026*** (14.54)	-0.0024*** (-3.96)
Control Variables	No	Yes
Cons	0.8869*** (21.28)	13.3124** (3.26)
Fixed Effect	Yes	Yes
R²	0.2167	0.2960

As illustrated in Table 4, the model regression coefficient is negative and significant at the 1% level, indicating that digital financial inclusion has a significant inhibitory effect on alternative variables, and the above conclusions are robust.

4.3. Conduction mechanism test

On the basis have been explained above, digital inclusive finance may affect regional carbon emissions by prompting energy efficiency and upgrading industrial structure. To identify digital financial inclusion influence on the above intermediary variables, the mechanistic checking is proved in Table 5 and Table 6.

Table. 5 Results of the conduction mechanism of energy efficiency

Variable	Energy efficiency		
	Model(1)	Model(2)	Model(3)
dig	-0.0012** (-2.33)	0.0013*** (3.82)	-0.0008*** (-4.21)
Control Variables	Yes	Yes	Yes
Cons	13.1004*** (3.61)	3.1544 (1.09)	3.3798** (2.52)
Fixed Effect	Yes	Yes	Yes
R²	0.1310	0.5618	0.8459

According to the mechanism analysis in Table 5, digital financial inclusion can significantly curb regional carbon emissions by improving energy efficiency. The regression coefficient of Model (2) is positive and significant at the 1% level, indicating that the development of digital inclusive finance plays a positive role in promoting the improvement of energy efficiency. Digital inclusive finance pushes the transformation of energy consumption structure, as the global Sustainable Development Goals continue to advance, digital financial inclusion offers support and incentives to environmentally friendly enterprises to reduce their dependence on traditional energy sources such as coal and increase the utilization of clean energy such as solar, wind and water. Model (3) shows that after controlling for energy efficiency, the inhibitory effect of digital inclusive finance on carbon emissions is reduced. All in all, the development of digital inclusive finance promotes the improvement of energy efficiency, thus decreasing carbon emissions. Therefore, the hypothesis 2 was validated.

Table. 6 Analysis results of the transmission mechanism of industrial structure upgrading.

Variable	Upgrading of industrial structure		
	Model(1)	Model(2)	Model(3)
dig	-0.0012** (-2.33)	0.0026*** (10.68)	-0.0002* (-2.03)
Control Variables	Yes	Yes	Yes
Cons	13.1004*** (3.61)	6.9754*** (4.18)	3.0906*** (5.12)
Fixed Effect	Yes	Yes	Yes
R²	0.1310	0.0308	0.0937

According to the mechanism analysis results in Table 6, digital inclusive finance significantly inhibits regional carbon emissions by promoting the upgrading of industrial structures. The regression coefficient of Model (2) is positive and significant at the 1% level, suggesting that the development of digital inclusive finance makes a positive difference in promoting the optimization and upgrading of industrial structure. Specifically, digital inclusive finance has a high degree of openness and freedom, which can be efficiently integrated with other industries and reduce the issue of information asymmetry. Moreover, the rapid development of digital inclusive finance assists small and medium-sized entrepreneurs obtain working capital, making breakthroughs in technological innovation, and then quickly eliminating degraded traditional industries so that the industrial structure can develop in a more advanced direction. What’s more, digital inclusive finance can catalyze credit mechanisms in a more complete and comprehensive direction, and the credit mechanism is the institutional support for the upgrading industrial structure. According to Model (3) after controlling for the intermediary variable of upgrading industrial structure, carbon emissions are not expected to be significantly weakened by the development of digital financial inclusion. In summary, digital inclusive finance promotes the optimization and upgrading of industrial structures, thereby reducing carbon emissions. Thereby, the hypothesis 3 was validated.

4.4. Heterogeneity Analysis

4.4.1 Regional Heterogeneity

Owing to the economic discrepancy, resource endowment, and geographical conditions among provinces in China to further verify whether the carbon emission reduction effect of digital inclusive finance is universal in different regions, this essay divides the development of digital inclusive finance into three groups according to regional heterogeneity and conducts regression analysis in three groups: eastern, central, and western according to regional heterogeneity, as illustrated in Table 7.

Table. 7 Regional heterogeneity results

Variable	Eastern	Central	Westward
dig	-0.0015*** (-5.20)	0.0023 (1.10)	-0.0022*** (-3.21)
Tech	0.0341 (1.44)	0.0783 (1.15)	0.0542** (2.45)
Eco	-0.3908 (-1.03)	-1.5847 (-1.35)	-0.6667 (-1.66)
Pop	1.4367*** (3.64)	0.1463 (0.07)	0.6102 (1.00)
Urb	2.1222*** (4.15)	-4.3524* (-1.33)	4.6222*** (4.45)
GDP	1.15e-07 (0.08)	-0.0000** (-2.09)	-7.74e-06* (-1.71)
Cons	0.9597 (0.33)	16.5447 (1.53)	7.2083* (1.88)
Fixed Effect	Yes	Yes	Yes
F	418.35	23.29	280.37
R²	0.0111	0.1146	0.1191

Through the analysis in Table 7, it is seen that digital inclusive finance has a significant carbon emission reduction effect in the eastern and western regions. The main reason may be that the rapid economic growth of the western and eastern regions, the large number of low-carbon technology innovations and applications, and the good coordination of the environment have reduced carbon emissions. The results in the central region are not notable, the reason for that may be the central region is still at the developing stage. In other words, its effect on carbon emission reduction has not yet fully emerged, but it also shows that it has great development potential. Concerning central and western that lay a relatively weaker foundation for the development of digital inclusive finance.

Consumers are also relatively lacking in digital literacy. Therefore, the western and central regions of China should vigorously improve the supply capacity of digital inclusive finance and strengthen the publicity to persistently narrow the gap in digital inclusive finance.

4.4.2 Heterogeneity in the level of financial development

Since the reform and opening, the central government has implemented an unbalanced development strategy and a policy of favoring investment, which has brought about a huge gap in the capacity of the regional economic situation. With the evolution of the monetization process, a large amount of physical capital has acquired the corresponding form of financial assets, the most important of which is the securities market. The eastern region has attracted a large amount of capital from the central and western regions that pursue the maximization of returns and gradually produced the “Matthew effect” in economic development and the “reverse flow effect” of Muirdahl. In addition to the above factors, the per capita years of education, the inflow of foreign capital, and the economic foundation also affect the unbalanced development of regional finance to some degree. In this essay, we were divided into two groups for regression analysis according to the high and low levels of financial level, as illustrated in Table 8.

Table. 8 The results of the heterogeneity of finance

Variable	The level of financial development is higher	The level of financial development is lower
dig	-0.0010*** (-4.29)	-0.0017** (-2.59)
Control Variables	Yes	Yes
Cons	2.7737 (1.38)	10.3474* (1.84)
Fixed Effect	Yes	Yes
R²	0.1034	0.1680

According to Table 8, the influence of digital inclusive finance on regional carbon emissions is significantly inhibiting in regions with higher financial levels as well as lower levels. The impact coefficients on areas with higher financial levels and those with lower are 0.0010 and 0.0017, respectively, indicating that digital inclusive finance has a greater incentive effect on carbon emission reduction in financially underdeveloped areas, and further manifests that areas with lower financial development levels will play a more critical role in the process of achieving the “dual carbon” goals and sustainable development.

5. Conclusions

Based on China's provincial panel data from 2011 to 2020, this essay uses a fixed-effect model to investigate the impact and mechanism of digital inclusive finance on regional carbon emissions. The results show that: (1) The development of digital inclusive finance has a significant inhibitory effect on regional carbon emissions, and the robustness of the empirical results is proved by replacing the explanatory variables for robustness. (2) The results of mechanism discussions explain that digital inclusive finance has an indirect effect on carbon emissions by the path of promoting improving energy efficiency and upgrading industrial structure. Among them, the upgrading of industrial structure is manifested in part of the intermediary effect. (3) Heterogeneity analysis manifests that digital inclusive finance has a restraining influence on carbon emissions in the western and eastern regions and shows an inhibitory effect in areas with higher and lower financial development. Moreover, the inhibitory effect is more significant in areas with lower levels of financial development.

Based on the above empirical research conclusions, this essay puts forward the following countermeasures and advice: Firstly, to strengthen the construction of inclusive financial infrastructure in the digital economy era, empowering carbon emissions reduction. The construction of digital infrastructure such as big data, artificial intelligence, and the Internet of Things prone to be developed energetically, accelerates the realization of high-level and high-quality interconnection, providing strong infrastructure support for digital inclusive finance. Secondly, comprehensively consider the differences in regional endowments and implement differentiated carbon emission reduction governance strategies. Adjust the process of digital inclusive finance in each region regarding the actual situation and consummate the governance of digital inclusive finance. Local governments are supposed to attach importance to promoting the level of industrial digitization and digital industrialization, guiding and encouraging all regions to constantly refine the penetration of digital inclusive finance. Thirdly, focus on regional breakthroughs in key technological innovation, improve the ability of independent innovation, drive energy efficiency with technological innovation, taking full advantage of the development of digital inclusive finance. Local governments should encourage enterprises to apply environmentally friendly and efficient technologies, provide financial and policy support for companies to improve energy utilization efficiency, and actively promote sustainable economic development. Fourthly, in terms of the need for industrial structure upgrading,

all regions should innovate the concept of digital inclusive financial development, incorporate it into the current financial reform policies and measures system, organically join digital inclusive finance and upgrading industrial structure together, better leverage the penetration of digital technology to promote digital industrialization and industrial digital development, providing a beneficial environment for the product and service innovation of digital inclusive finance contribute to catering diverse needs for market players.

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