ASSESSING HOW THE DIGITAL ECONOMY DRIVES HIGH-QUALITY REGIONAL ECONOMIC DEVELOPMENT

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The digital economy is reshaping regional growth by supplying new momentum and acting as a major driver of high-quality development. This study distinguishes both the direct contribution of the digital economy to regional coordination and its indirect influence through strengthening technological innovation. Using provincial-level data from China covering 2015–2023, the paper conducts empirical analysis with bidirectional fixed-effects models, mediation-effect tests, and geographic detector methods. The findings show that the digital economy significantly enhances high-quality regional economic development, while its impact varies across regions and is especially strong in central, western, and southern China. Technological innovation emerges as a crucial transmission channel, and deeper interregional innovation collaboration further improves coordinated, high-quality development outcomes. Overall, the study offers a new theoretical basis for promoting cross-regional cooperation in the digital economy.

Index Terms —two-way fixed effects model, mediating effects model, geodetector, digital economy, regional economy

INTRODUCTION

The G20 Digital Economy Development and Cooperation Initiative, adopted at the 2016 G20 Hangzhou Summit, characterizes the digital economy as a set of economic activities in which digital knowledge and information function as fundamental production inputs, modern information networks serve as essential infrastructure, and information and communication technologies (ICT) are employed to optimize economic structures and improve efficiency [1]. With the rapid commercialization and widespread application of next-generation information technologies—such as mobile internet, 5G, big data analytics, and artificial intelligence—capabilities related to data acquisition, storage, and analysis have expanded markedly. These advances are driving a new wave of technological innovation and industrial upgrading toward more advanced stages. As countries around the world continue to deepen digital transformation, the digital economy has assumed an increasingly prominent role in national development strategies and has become a critical engine of global economic growth [2]–[4]. According to Mao, Y. et al., between 2008 and 2022 China's digital economy recorded an average annual growth rate of nearly 15% in value-added output, far exceeding the contemporaneous growth rate of GDP [5]. The rapid expansion and strong momentum of the digital economy have led governments worldwide to recognize its strategic importance in fostering regional economic development. Consequently, nations are actively leveraging digital economic development to strengthen their competitiveness in the global economy and secure advantages for future growth.

In recent years, the accelerating expansion of the digital economy has made its transformative impact on the global economic system increasingly apparent. Knickrehm, M. et al. argue that the digital economy is pushing the global technological revolution and industrial transformation into a deeper phase, becoming a central force behind technological innovation and the modernization of economic systems worldwide [6]. Early research on the relationship between the digital economy and economic growth primarily focused on the contribution of digital technologies and services to economic performance. Mgadmi, N. et al. analyzed data from both developed and developing countries over the period 1990–2020 and found that the digital economy exerts a significant positive effect on economic growth, clarifying the linkage between ICT development and economic expansion [7]. Jiao, S. and Sun, Q. examined the role of digital economic development in China's urban growth and observed positive but regionally heterogeneous effects, mediated by entrepreneurial activity and characterized by spatial spillover phenomena [8]. Using mediation analysis and spatial Durbin models, Ding, C. et al. studied 30 Chinese provinces from 2011 to 2019 and concluded that the digital economy significantly promotes high-quality economic development, with pronounced spatial spillover effects [9]. Similarly, Murthy, K. et al. found that developed economies benefit from strong network externalities, with close linkages between economic growth and mobile digital services. Their findings reveal bidirectional causality between digital variables and growth and suggest that the digital divide disproportionately favors developed economies, particularly in the domain of e-commerce [10]. Chen, W. et al. further demonstrated a U-shaped relationship between the digital economy and regional total factor productivity (TFP), identifying innovation and entrepreneurship as key channels through which TFP improvements are realized [11].

As a new stage of economic development following agricultural and industrial economies, the digital economy has become a key driver of deep structural transformation in society and the economy. Its essence lies in digital technologies and the innovative business models built upon them [12], [13]. Existing literature has extensively explored the relationship between the digital economy and economic growth. From a macroeconomic perspective, Sawng, Y. et al. found that ICT primarily stimulates economic growth in the short term, a conclusion later supported by subsequent studies [14]. Ward, M. and Zheng, S. further noted that the growth effects of the digital economy vary according to regional development levels [15]. Thompson Jr., H. and Garbacz, C. argued that informatization has a stronger growth-enhancing impact in low-income regions than in high-income ones, enabling less-developed areas to narrow the economic gap through ICT-driven development [16]. With the widespread diffusion of ICT, Niebel, T. observed that the relative prices of ICT

equipment tend to decline more rapidly in developed economies, attracting increased ICT investment and generating learning-by-doing effects that further stimulate economic growth [17].

At the microeconomic level, research has largely concentrated on how the digital economy promotes industrial upgrading, optimizes resource allocation, and enhances firm-level innovation and entrepreneurship. Li, M. and Du, W. found that the application of digital technologies increases firms' innovation output by alleviating inefficiencies in the allocation of innovation resources [18]. Chang, X. et al. examined the role of the digital economy in industrial restructuring from the perspective of innovation factor allocation and showed that improvements in resource allocation significantly accelerate structural transformation, offering policy implications for sustainable development [19]. Song, Y. and Jiang, Y. demonstrated that the digital economy contributes positively to the rationalization and upgrading of China's industrial structure, with notable regional heterogeneity. This effect operates through innovation, is moderated by economic resilience, and exhibits threshold characteristics [20]. Pang, J. et al. showed that the digital economy promotes industrial upgrading by improving the allocation efficiency of capital and labor, especially in less-developed regions, thereby providing a pathway toward sustainable growth and escape from the "poverty trap" [21]. Li, R. et al. identified a positive relationship between regional digital economic development and corporate innovation, noting that digital transformation acts as a secondary channel while firm efficiency plays a reinforcing moderating role [22]. Zhao, S. et al. further confirmed that the digital economy significantly enhances urban industrial upgrading and service-sector expansion in China through technological progress and human capital accumulation, while also generating positive spillover effects in neighboring regions [23].

To systematically analyze the mechanisms and practical effects through which the digital economy influences high-quality regional economic development, this study constructs a comprehensive theoretical framework incorporating both direct and indirect pathways. It first investigates the direct role of the digital economy in shaping regional development disparities and then examines its indirect effects through technological innovation as a mediating mechanism. By employing fixed-effects models, mediation analysis, and geographic detection techniques, the paper explores how the digital economy affects high-quality regional development, regional inequality, and specific driving factors. Using China as the empirical context, the study conducts econometric analysis to test the robustness and validity of the proposed framework.

THEORETICAL ANALYSIS AND RESEARCH HYPOTHESES

In comparison with conventional agricultural and industrial development models, the digital economy demonstrates a range of distinctive characteristics, including economies of scale, economies of scope, and long-tail effects. These attributes confer unique competitive advantages, enabling the digital economy to exert broad and profound influences on economic growth and development by lowering transaction costs, enhancing overall productivity, and accelerating disruptive technological change. Owing to these features, the digital economy plays a pivotal role in reshaping interregional economic linkages and growth dynamics.

First, the digital economy inherently exhibits strong spatial spillover effects, which largely arise from its virtual and non-physical nature. As core elements of the digital economy, data and digital technologies are embedded in production processes in intangible forms, thereby stimulating economic growth. More importantly, these virtual characteristics are marked by non-excludability and spatial openness, significantly reducing barriers to interregional interaction and cooperation. Emerging internet-based economic forms—such as platform economies and virtual digital products—exemplify how the digital economy facilitates the integration and sharing of information resources across regions.

The technological infrastructure underpinning the digital economy—including blockchain, cloud computing, big data, and 5G—possesses wide-ranging applicability and enables deep integration across primary, secondary,

and tertiary industries. Through the interaction between digital technologies and data resources, industrial chains undergo innovative convergence, giving rise to new "Internet Plus" business models. Cross-industry co-construction and resource-sharing mechanisms not only reorganize industrial structures and reshape production layouts but also alter the spatial configuration of regional industries through the diffusion and application of digital technologies. Moreover, the pervasive nature of digital technologies promotes mutual reinforcement and penetration between emerging and traditional technologies. As this technological ecosystem expands, temporal and spatial constraints are further weakened, allowing digital pathways to connect diverse industries and regions through new application scenarios. Consistent with neoclassical growth theory, sustained economic growth depends fundamentally on technological progress. The digital economy not only stimulates synchronized innovation across sectors but also substantially shortens the time lag in technology diffusion among regions, thereby promoting more coordinated regional economic development.

Finally, the transmission and driving effects of the digital economy facilitate the spread of digital transformation from one production sector to others and even extend into non-production domains. Digital transformation typically originates within specific production sectors, initially reshaping computing and information communication systems and linking cities and regions into a shared technological foundation. Subsequently, advances in computing technologies transform material production processes, triggering digital upgrading in manufacturing and equipment-intensive industries. Productivity gains in these sectors then induce digital transformation in non-production activities. For example, front-end development and terminal services digitize the entire value chain, from research and development to production and market distribution. Concurrently, digital transformation in production sectors promotes reforms in digital governance, including enterprise digital management and e-government systems. Through these horizontal transmission effects, the digital economy enhances overall social productivity across regions.

Hypothesis 1: The digital economy directly promotes high-quality regional economic development.

The expansion of the digital economy provides substantial support for the growth of small and medium-sized enterprises (SMEs). It improves the efficiency of capital allocation, expands access to skilled human resources, and significantly stimulates firms' innovative capacity. By enabling SMEs to enter emerging industries, generate social value, and accelerate industrial upgrading, the digital economy contributes to the optimization of regional economic structures. Furthermore, by strengthening technological innovation capabilities, enhancing public digital literacy, and unlocking local resource potential, the digital economy establishes an integrated resource platform that supplies sustained momentum for high-quality economic development. The application of digital technologies has also markedly improved poverty alleviation outcomes, indirectly supporting high-quality regional development and enhancing the precision of poverty reduction policies. In addition, the digital economy mitigates traditional financial risks, promotes efficient resource circulation and sharing, unleashes corporate innovation potential, expands employment opportunities, and injects strong driving forces into high-quality economic growth. Overall, technological innovation serves as the fundamental channel through which the digital economy advances high-quality economic development.

Hypothesis 2: The digital economy promotes high-quality regional economic development by enhancing the level of technological innovation.

RESEARCH DESIGN

Variable Definition

The dependent variable in this study is the composite index measuring high-quality economic development. At present, there is no universally accepted standard for quantifying high-quality economic development. Early

studies often relied on indicators related to sustainable development or social welfare. As academic research has expanded, a broader range of measurement approaches has emerged. Existing studies generally adopt one of two strategies. The first uses total factor productivity (TFP) as a proxy for the quality of economic growth. The second approach, developed following the introduction of China's "New Development Philosophy," constructs evaluation indicators based on five core development concepts. Although TFP captures certain aspects of economic performance from environmental and social perspectives, it remains insufficient to fully reflect the multidimensional nature of high-quality development. The New Development Philosophy was formulated during a critical stage in China's economic transition toward a new development paradigm, making it more consistent with the country's current structural conditions. Accordingly, this paper constructs a high-quality economic development indicator system grounded in the five development concepts.

Existing literature primarily measures digital economic development using two methods. The first constructs indices based on internet search intensity to capture digital activity, while the second employs digital inclusive finance indices as proxies for digital economic development. The Digital Inclusive Finance Index is jointly developed using micro-level data from Ant Group and research outputs from Peking University's Digital Economy Research Center. This index evaluates digital economic development across three dimensions: coverage breadth, depth of use, and degree of digitalization. Given Ant Group's extensive market presence and comprehensive data coverage, this index offers a reliable representation of digital economic development. In contrast, indices derived from online search popularity suffer from limitations related to time sensitivity, accuracy, and coverage. Therefore, this study adopts the Digital Inclusive Finance Index as a proxy for the level of digital economic development.

The logarithm of the digital economic development level is used as the explanatory variable (lnDIG), while the logarithm of the high-quality regional economic development index serves as the dependent variable (lnRECD).

To reduce potential estimation bias, several control variables are included: government intervention level (GOV), financial development level (FIN), transportation infrastructure development level (lnTRA), industrial structure upgrading (STR), and urbanization level (UL).

Technological innovation is introduced as a mediating variable. Technology market transaction volume reflects both market activity and the overall scale of transforming scientific and technological achievements into economic outcomes. The ratio of technology market transaction volume to GDP is therefore used to measure provincial technological innovation capacity (TECH).

Factors influencing regional divergence in high-quality economic development. To analyze divergence patterns in regional high-quality economic development, six influencing factors are examined: digital economic development, government intervention, financial development, transportation infrastructure, industrial structure upgrading, and urbanization level. The natural breakpoint method is applied to classify each factor into four categories annually, with corresponding values assigned to each group.

Data Sources

This study employs panel data from selected Chinese provinces covering the period from 2015 to 2023. The data are obtained from the China Statistical Yearbook, the China Digital Economy White Paper, and provincial statistical yearbooks. Due to data limitations and incomplete records, missing values are addressed using the average incremental interpolation method.

Table 1 reports the descriptive statistics for all variables. The results indicate that the overall level of high-quality economic development is moderate, with an average value of 0.686. Considerable disparities are

observed in coordinated economic development across regions. The control variables suggest that government intervention plays a noticeable role in economic development. Substantial regional differences exist in the degree of industrial structure upgrading, while transportation infrastructure, financial development, and urbanization levels remain uneven across provinces. In addition, technological innovation capacity varies significantly among regions, reflecting pronounced regional heterogeneity.

Table 1: Descriptive statistics

Variable	Obs.	Min	Max	Mean	Std. Dev.
RECD	300	0.421	0.791	0.686	0.098
DIG	300	0.102	0.630	0.268	0.112
GOV	300	0.109	0.758	0.255	0.108
STR	300	2.196	2.836	2.400	0.119
TRA	300	0.045	1.422	0.429	0.247
FIN	300	1.904	7.575	3.501	1.080
UL	300	0.375	0.897	0.608	0.110
TECH	300	0.004	0.173	0.020	0.029

MODEL SPECIFICATION

Fixed Effects Model

The fixed effects model [24] is a commonly used panel data method for analyzing individual heterogeneity in longitudinal datasets. In this framework, individual-specific effects are assumed to be time-invariant constants. By eliminating these fixed effects through within transformation, the model controls for unobservable individual characteristics,thereby allowing more accurate estimation of the impacts of explanatory variables on the dependent variable over time. This approach effectively reduces omitted-variable bias and enhances the robustness of empirical results.

Based on the theoretical framework developed above, this study assumes that the digital economy directly promotes high-quality regional economic development and may also exert indirect effects through mediating mechanisms. Accordingly, a two-way fixed effects model incorporating both regional and time effects is constructed as follows:

$$\ln RECD_{it} = \beta_0 + \beta_1 \ln DIG_{it} + \beta_2 X_{it} + \alpha_i + \theta_t + \varepsilon_{it}, \quad i = 1, \ldots, n;\ t = 1, \ldots, T \tag{1}$$

where i denotes the province and t denotes the year. The dependent variable $\ln RECD_{it}$ represents the level of high-quality regional economic development, $\ln DIG_{it}$ measures the level of digital economic development, X_{it} is a vector of control variables, α_i denotes regional fixed effects, θ_t represents time fixed effects, and ε_{it} is the random error term.

Mediation Effect Model

Mediation effect models [25] are employed to examine whether the influence of an independent variable on a dependent variable operates through an intermediate variable. In this study, a stepwise regression approach is used to test for mediation effects.

First, the independent variable is regressed on the dependent variable. Second, the independent variable is regressed on the mediating variable. Third, both the independent variable and the mediating variable are included simultaneously in the regression to assess whether the coefficient of the independent variable declines, indicating a mediation effect.

Based on the baseline fixed effects model, the following mediation equations are specified, where Med_{it} denotes technological innovation:

$$\ln RECD_{it} = \beta_0 + \beta_1 \ln DIG_{it} + \beta_2 X_{it} + \alpha_i + \theta_t + \varepsilon_{it} \tag{2}$$

$$Med_{it} = \gamma_0 + \gamma_1 \ln DIG_{it} + \gamma_2 X_{it} + \alpha_i + \theta_t + \varepsilon_{it} \tag{3}$$

$$\ln RECD_{it} = \mu_0 + \mu_1 \ln DIG_{it} + \mu_2 Med_{it} + \mu_3 X_{it} + \alpha_i + \theta_t + \varepsilon_{it} \tag{4}$$

Geodetector Model

Geodetector [26] is a statistical method used to detect spatial heterogeneity and identify the driving forces behind spatial variation. The core assumption is that if an explanatory factor significantly influences a dependent variable, their spatial distributions should exhibit similarity. This method does not require linear assumptions and is robust to multicollinearity.

This study focuses on the factor detection component of the Geodetector method, using indicators of digital economy development as explanatory variables. The analysis is conducted at the national level as well as for eastern, central, and western regions of China.

The explanatory power of each factor is measured using the q statistic:

$$q = 1 - \frac{SSW}{SST} = 1 - \frac{\sum_{h=1}^{L} N_h \sigma_h^2}{N\sigma^2} \tag{5}$$

where q denotes the explanatory power of a given digital economy indicator for high-quality regional economic development; h represents the stratification of factor X_i; N is the total sample size; σ^2 is the overall variance of X_i; SST is the total variance across all regions; and SSW is the sum of within-stratum variances. The value of q ranges from 0 to 1, with higher values indicating stronger explanatory power. Statistical significance is assessed using the corresponding p-value.

EMPIRICAL RESULTS AND ANALYSIS

Benchmark Regression Analysis

Table 2 reports the benchmark regression results examining the effect of digital economic development on high-quality regional economic development. Column (1) presents the baseline regression without fixed effects or control variables. The estimated coefficient indicates that a 1% increase in the level of digital economic development leads to a 0.209% increase in regional high-quality economic development, which is statistically significant at the 1% level.

Column (2) incorporates both regional and time fixed effects. The coefficient of digital economic development increases to 0.306% and remains significant at the 1% level, suggesting that controlling for unobserved

heterogeneity strengthens the estimated effect. Column (3) further includes control variables, and the coefficient remains positive and statistically significant at the 1% level, although its magnitude declines to 0.141%. These results indicate that even after accounting for observable and unobservable factors, digital economic development continues to exert a significant positive impact on high-quality regional economic development, thereby supporting Hypothesis 1.

Table 2: Benchmark Regression Results

	(1) lnRECD	(2) lnRECD	(3) lnRECD
lnDIG	0.209***	0.306***	0.141***
	(0.072)	(0.058)	(0.043)
Control variables	No	No	Yes
Regional fixed effects	No	Yes	Yes
Time fixed effects	No	Yes	Yes
N	300	300	300
R^2	0.054	0.534	0.709

Note: ***, **, * denote significance at the 1%, 5%, and 10% levels.

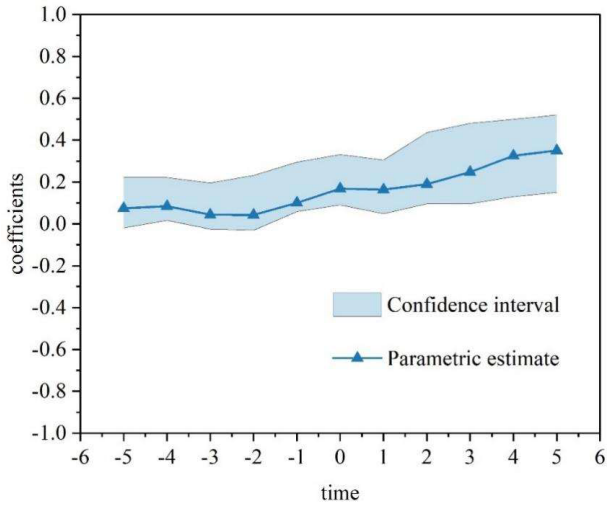

Figure 1: Parallel Trend Test

Parallel Trend Test

A critical prerequisite for applying the difference-in-differences framework is the parallel trend assumption, which requires that the treatment and control groups exhibit similar trends in high-quality regional economic development prior to policy implementation. To verify this assumption, an event study approach is employed using the following specification:

$$\ln RECD_{it} = \alpha_0 + \sum_{k=-m}^{n} \alpha_k \ln DIG_{i,t-k} + \alpha X_{it} + \mu_i + \theta_t + \varepsilon_{it} \tag{6}$$

Here, $\ln DIG_{i,t-k}$ is a policy dummy indicating whether region i implemented a digital economy policy in period $t-k$, where m and n denote the number of periods before and after policy implementation, respectively. The coefficients α_{-m} to α_{-1} capture pre-policy effects, while α_1 to α_n represent post-policy impacts.

Figure 1 illustrates the parallel trend test results. Prior to policy implementation, the estimated coefficients are statistically indistinguishable from zero, indicating no significant differences between treatment and control groups and thus validating the parallel trend assumption. Following policy implementation, the coefficients deviate significantly from zero and increase progressively over time, suggesting that digital economy policies exert a sustained and strengthening positive effect on high-quality regional economic development.

Multicollinearity Test

To ensure the reliability of regression estimates, variance inflation factor (VIF) tests were conducted to detect potential multicollinearity among explanatory and control variables. As reported in Table 3, all VIF values are below the critical threshold of 10, indicating that multicollinearity does not pose a concern and that all variables can be safely included in the regression model.

Table 3: Variance Inflation Factor (VIF) Test

Variable	VIF	1/VIF
lnRECD	1.45	0.690
FIN	1.41	0.709
GOV	1.25	0.800
lnTRA	1.23	0.813
STR	1.16	0.862
UL	1.11	0.901

Robustness Tests

To verify the robustness of the baseline results, placebo tests were conducted by randomly assigning fictitious treatment groups and policy implementation periods. Specifically, twelve provinces were randomly selected as a pseudo-treatment group, and a fictitious policy year was assigned. This process was repeated 1,500 times. As shown in Figure 2, the estimated coefficients are concentrated around zero, with most corresponding p-values exceeding 0.10, indicating no spurious policy effects.

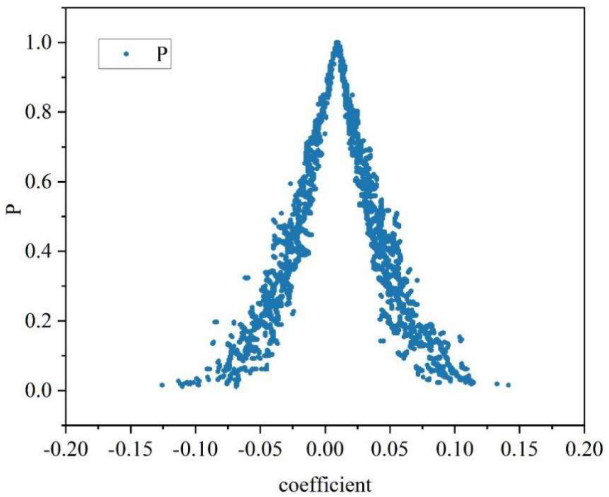

Figure 2: Placebo test results

Furthermore, to account for potential interference from other national policies, such as the *Broadband China*

pilot program and smart city initiatives, these policies were explicitly controlled for in the regression. Table 4 shows that the estimated effect of digital economic development remains positive and statistically significant, confirming the robustness of the main findings.

Table 4: Exclude Other Policy Interference Tests

	(1) lnRECD	(2) lnRECD	(3) lnRECD
lnDIG	0.145***	0.148***	0.140***
	(0.048)	(0.048)	(0.048)
Control variables	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
N	300	300	300
R^2	0.705	0.705	0.705

Note: ***, **, * denote significance at the 1%, 5%, and 10% levels.

Regional Heterogeneity Analysis

To explore regional heterogeneity, provinces were divided into eastern, central, and western regions. The regression results in Table 5 reveal that the digital economy significantly promotes high-quality economic development in central and western regions, with the strongest effect observed in the central region. In contrast, the effect is statistically insignificant in eastern provinces, where factor markets are relatively mature and resource constraints are more pronounced.

Table 5: Regional Heterogeneity Test Results

	Model (1) lnRECD	Model (2) lnRECD	Model (3) lnRECD	Model (4) lnRECD	Model (5) lnRECD
lnDIG	0.045	0.093**	0.048**	0.056***	0.012
	(1.310)	(2.570)	(2.160)	(2.640)	(0.810)
GOV	-0.044	-0.101	-0.084	-0.231*	-0.102**
	(-0.520)	(-1.220)	(-0.880)	(-1.830)	(-2.550)
FIN	0.005	0.004	0.003	-0.005	0.012***
	(0.560)	(0.670)	(0.150)	(-0.810)	(2.840)
lnTRA	0.021	0.015	0.073***	0.062**	0.004
	(0.970)	(0.940)	(2.810)	(2.610)	(0.400)
STR	0.082	-0.101***	-0.124	-0.215***	-0.052*
	(0.930)	(-3.310)	(-1.440)	(-3.340)	(-1.810)
UL	-0.381***	-0.424**	0.862**	-0.096	-0.333***
	(-2.850)	(-2.110)	(2.620)	(-0.610)	(-4.950)
Cons	-0.342	0.373*	-0.260	0.405**	-0.032
	(-1.610)	(1.830)	(-0.840)	(2.230)	(-0.330)
Time fixed effects	Control	Control	Control	Control	Control
Regional fixed effects	Control	Control	Control	Control	Control
R^2	0.465	0.503	0.566	0.485	0.582
N	56	46	54	72	72

Note: ***, **, * denote significance at the 1%, 5%, and 10% levels.

Further analysis based on a north–south regional division reveals that the digital economy has a significant

positive effect in southern regions but a weaker and insignificant effect in northern regions. These findings highlight substantial spatial heterogeneity in the developmental impact of the digital economy.

Mediating Effect of Technological Innovation

To test Hypothesis 2, technological innovation was introduced as a mediating variable. The results reported in Table 6 show that digital economic development significantly enhances technological innovation, and when technological innovation is included in the regression, the coefficient of the digital economy decreases but remains significant. The Sobel test confirms the presence of a partial mediation effect, indicating that the digital economy promotes high-quality regional economic development partly through improvements in technological innovation.

Table 6: Technological Innovation Mediation Effect Test Results

	Model (1) lnRECD	Model (2) TECH	Model (3) lnRECD
lnDIG	0.048***	0.015**	0.042***
	(3.362)	(2.072)	(2.953)
TECH		0.453***	
		(3.272)	
GOV	-0.145***	-0.015	-0.135***
	(-3.075)	(-0.720)	(-2.980)
FIN	0.012**	0.012***	0.004
	(2.032)	(4.720)	(1.000)
lnTRA	0.045***	-0.008	0.044***
	(3.210)	(-1.060)	(3.540)
STR	-0.135***	0.032**	-0.148***
	(-4.220)	(2.020)	(-4.720)
UL	-0.203**	0.193***	-0.116
	(-2.560)	(-5.320)	(-1.430)
Cons	0.179*	0.041	0.165
	(1.620)	(0.780)	(1.620)
Time fixed effects	Control	Control	Control
Regional fixed effects	Control	Control	Control
R^2	0.400	0.609	0.423
N	300	300	300
Goodman test	0.005* ($z = 1.745$)		
Mediation effect coefficient	0.005* ($z = 1.745$)		
Direct effect coefficient	0.042 ($z = 2.952$)		
Total effect coefficient	0.048 ($z = 3.359$)		
Ratio of mediating effect	0.133		

Note: ***, **, * denote significance at the 1%, 5%, and 10% levels.

Spatial Differentiation and Driving Factors

Using the Geodetector method, spatial differentiation in high-quality regional economic development was analyzed for the years 2015, 2018, 2021, and 2023. Table 7 reports the q-values for each influencing factor. Industrial structure upgrading consistently emerges as the most influential factor, followed by urbanization

and digital economic development. Although the explanatory power of the digital economy declines over time, it remains a key driver of spatial differentiation.

Table 7: Spatial Diversity Detection Results

Year	lnDIG	GOV	FIN	lnTRA	STR	UL
2015	0.605***	0.155	0.422*	0.495**	0.705***	0.695***
2018	0.473**	0.026	0.400	0.455*	0.726***	0.708***
2021	0.372**	0.036	0.635**	0.458*	0.599**	0.686***
2023	0.333*	0.044	0.632**	0.377	0.960***	0.671***

Note: ***, **, * denote significance at the 1%, 5%, and 10% levels.

Interaction detection results further reveal that combinations of factors exhibit stronger explanatory power than individual factors alone, demonstrating dual-factor and nonlinear enhancement effects. These findings suggest that the digital economy influences regional high-quality development primarily through synergistic interactions with other socioeconomic factors rather than through isolated effects.

CONCLUSION

This study systematically examines the impact of the digital economy on high-quality regional economic development using panel data from Chinese provinces. The empirical results demonstrate that digital economic development significantly and robustly promotes high-quality regional economic growth, with pronounced spatial spillover effects and clear regional heterogeneity. The positive influence is stronger in central, western, and southern regions, highlighting the digital economy's role in narrowing regional development disparities. Further analysis reveals that technological innovation serves as a key mediating mechanism through which the digital economy enhances development quality, while spatial differentiation analysis confirms that the digital economy interacts with factors such as industrial structure upgrading and urbanization to jointly shape regional development patterns. Overall, the findings underscore the digital economy as a critical driver of coordinated, innovation-led, and high-quality regional economic development, providing important empirical evidence for formulating differentiated and region-specific digital development policies.

REFERENCES

[1] Jain, S. (2022). The G20 digital economy agenda for India. In The G20 digital economy agenda for India: Jain, Shruti. New Delhi, India: ORF, Observer Research Foundation.

[2] Yang, H. (2023). Construction of the new development dynamic and development of digital economy: internal logic and policy focus. China Political Economy, 6(2), 92-113.

[3] Aniqoh, N. A. F. A. (2020). The role of digital economy to enhancing sustainable economic development. International Journal of Social Science and Business, 4(4), 519-527.

[4] Qi, Y., & Chu, X. (2022). Development of the digital economy, transformation of the economic structure and leaping of the middle-income trap. China Political Economy, 5(1), 14-39.

[5] Mao, Y., Niu, M., Zhang, Y., & Wang, Z. (2023). How does the digital economy affect value-added in China? Dual perspectives from digital demand and supply. Applied Economics, 55(58), 6832-6854.

[6] Knickrehm, M., Berthon, B., & Daugherty, P. (2016). Digital disruption: The growth multiplier. Accenture Strategy, 1, 1-11.

[7] Mgadmi, N., Moussa, W., Béjaoui, A., Sadraoui, T., & Afef, G. (2021). Revisiting the nexus between digital economy and economic prosperity: evidence from a comparative analysis. Journal of Telecommunications and the Digital Economy, 9(2), 69-91.

[8] Jiao, S., & Sun, Q. (2021). Digital economic development and its impact on econimic growth in China: Research based on the prespective of sustainability. Sustainability, 13(18), 10245.

[9] Ding, C., Liu, C., Zheng, C., & Li, F. (2021). Digital economy, technological innovation and high-quality economic development: Based on spatial effect and mediation effect. Sustainability, 14(1), 216.

[10] Murthy, K. B., Kalsie, A., & Shankar, R. (2021). Digital economy in a global perspective: Is there a digital divide?. Transnational Corporations Review, 13(1), 1-15.

[11] Chen, W., Du, X., Lan, W., Wu, W., & Zhao, M. (2023). How can digital economy development empower high-quality economic development?. Technological and Economic Development of Economy, 29(4), 1168-1194.

[12] Brenner, B. (2018). Transformative sustainable business models in the light of the digital imperative—A global business economics perspective. Sustainability, 10(12), 4428.

[13] Witschel, D., Döhla, A., Kaiser, M., Voigt, K. I., & Pfletschinger, T. (2019). Riding on the wave of digitization: Insights how and under what settings dynamic capabilities facilitate digital-driven business model change. Journal of Business Economics, 89(8), 1023-1095.

[14] Sawng, Y. W., Kim, P. R., & Park, J. (2021). ICT investment and GDP growth: Causality analysis for the case of Korea. Telecommunications Policy, 45(7), 102157.

[15] Ward, M. R., & Zheng, S. (2016). Mobile telecommunications service and economic growth: Evidence from China. Telecommunications Policy, 40(2- 3), 89-101.

[16] Thompson Jr, H. G., & Garbacz, C. (2011). Economic impacts of mobile versus fixed broadband. Telecommunications Policy, 35(11), 999-1009.

[17] Niebel, T. (2018). ICT and economic growth–Comparing developing, emerging and developed countries. World development, 104, 197-211.

[18] Li, M., & Du, W. (2021). Can Internet development improve the energy efficiency of firms: Empirical evidence from China. Energy, 237, 121590.

[19] Chang, X., Yang, Z., & Abdullah. (2024). Digital economy, innovation factor allocation and industrial structure transformation—A case study of the Yangtze River Delta city cluster in China. Plos one, 19(4), e0300788.

[20] Song, Y., & Jiang, Y. (2024). How does the digital economy drive the optimization and upgrading of industrial structure? the mediating effect of innovation and the role of economic resilience. Sustainability, 16(4), 1352.

[21] Pang, J., Zhang, Y., & Jiao, F. (2023). The impact of the digital economy on transformation and upgrading of industrial structure: A perspective based on the “Poverty Trap”. Sustainability, 15(20), 15125.

[22] Li, R., Rao, J., & Wan, L. (2022). The digital economy, enterprise digital transformation, and enterprise innovation. Managerial and Decision Economics, 43(7), 2875-2886.

[23] Zhao, S., Peng, D., Wen, H., & Song, H. (2022). Does the digital economy promote upgrading the industrial structure of Chinese cities?. Sustainability, 14(16), 10235.

[24] Georgia Zournatzidou,George Sklavos,Konstantina Ragazou & Nikolaos Sariannidis. (2025). Investigating Factors Affecting Loan Loss Reserves in the US Financial Sector: A Dynamic Panel Regression Analysis with Fixed-Effects Models. Journal of Risk and Financial Management,18(2),105- 105.

[25] Han Dongchu & Liu Mianfang. (2022). How Does the Digital Economy Contribute to Regional Green Development in China? Evidence-Based on the Intermediary Effect of Technological Innovation. Sustainability,14(18),11147-11147.

[26] Heng Zhao,Yingying Gai,Fuqiang Wang,Lanbo Cui,Yutian Du,Heng Wang... & Huan Yang. (2025). Investigation into the supply-demand relationship of carbon sequestration in the yellow river basin using the optimal parameter geographical detector model. Scientific Reports,15(1),29079-29079.

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