

Digital Economy and Rural Tourism Development in China: A Coupling Coordination Analysis Across Provinces

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ABSTRACT

This study examined the relationship between the digital economy and rural tourism development in China from 2020 to 2024 using the Coupling Coordination Theory framework. Specifically, it analyzed the characteristics of the digital economy and rural tourism development, assessed regional differences according to geographic location, fixed-asset investment levels, and natural resource endowments, and evaluated the coupling coordination relationship between the two systems. A quantitative descriptive-correlational design utilizing panel data from 30 Chinese provinces was employed. The digital economy was measured through digital infrastructure, digital industry development, and digital inclusive finance, while rural tourism development was assessed through environmental, economic, and social dimensions. The Entropy Weight Method, TOPSIS, Analysis of Variance, and the Coupling Coordination Degree Model were used for data analysis. Findings revealed that the digital economy demonstrated steady growth, primarily driven by digital infrastructure and digital inclusive finance. Rural tourism development likewise improved during the study period but remained uneven across regions. Significant regional differences were identified in both systems, particularly when provinces were grouped according to geographic location and natural resource endowments. The coupling coordination analysis showed a progressively strengthening relationship between the digital economy and rural tourism development, although overall coordination remained at a transitional stage. Geographic location emerged as the most influential source of spatial heterogeneity. The study concludes that digital transformation serves as a critical driver of rural tourism development and rural revitalization in China. However, achieving balanced and sustainable development requires region-specific policies that address disparities in digital infrastructure, investment capacity, and tourism resources.

Keywords: Digital economy, rural tourism development, coupling coordination, rural revitalization, spatial heterogeneity, China.

INTRODUCTION

The digital economy has become a major driver of economic transformation and sustainable development in the twenty-first century. Rapid advancements in information and communication technologies (ICTs), artificial intelligence, big data analytics, cloud computing, blockchain technology, and digital platforms have reshaped production systems, business operations, and regional development patterns (Liu et al., 2023; Zhang & Chen, 2024). As digital technologies continue to penetrate various sectors of society, they facilitate innovation, improve productivity, enhance resource allocation efficiency, and strengthen economic resilience (Wang et al., 2022; Zhao et al., 2024). Consequently, governments worldwide have increasingly adopted digital transformation strategies to promote inclusive growth and long-term competitiveness in an increasingly interconnected global economy (United Nations, 2023).

China has emerged as one of the world's leading digital economies. Over the past decade, the country has implemented comprehensive policies aimed at expanding digital infrastructure, strengthening internet connectivity, promoting e-commerce development, and advancing digital financial services (Li et al., 2023; Xu & Yang, 2024). These initiatives have significantly accelerated digital transformation across both urban and rural

areas. Recent reports indicate that the digital economy contributes substantially to China's national output and serves as an important engine of economic growth and modernization (CAICT, 2024). Beyond its economic contributions, digital transformation has increasingly become a strategic tool for addressing regional development disparities and supporting rural revitalization efforts (Huang et al., 2023).

The promotion of rural revitalization remains a national priority in China. Despite remarkable economic progress, substantial disparities continue to exist between urban and rural regions in terms of infrastructure, income levels, access to services, and development opportunities (Chen & Liu, 2023). In response, the Rural Revitalization Strategy emphasizes the modernization of rural industries, improvement of living conditions, enhancement of public services, and promotion of sustainable development (Zhang et al., 2022). Within this context, digital technologies have demonstrated significant potential to overcome geographical constraints, improve market access, facilitate financial inclusion, and strengthen rural entrepreneurship (Guo et al., 2023; Yang & Li, 2024). Digital transformation has therefore become increasingly recognized as an important mechanism for stimulating rural economic development and improving rural livelihoods.

Among the sectors benefiting from digital transformation, tourism has emerged as one of the most dynamic contributors to rural development. Rural tourism plays an important role in generating employment, increasing household income, promoting local entrepreneurship, preserving cultural heritage, and supporting environmental conservation (Sun et al., 2023; Zhao & Wang, 2024). As demand for experiential and nature-based tourism continues to grow, rural destinations have gained increasing prominence within China's tourism industry. At the same time, digital technologies have transformed tourism development through online marketing, smart tourism platforms, digital payment systems, social media promotion, and data-driven destination management (Li & Zhou, 2023; Chen et al., 2024). These innovations have enhanced destination visibility, improved visitor experiences, and expanded market opportunities for rural tourism enterprises.

Recent studies suggest that digital economy development positively influences tourism performance by improving information accessibility, facilitating innovation, enhancing operational efficiency, and reducing transaction costs (Liu et al., 2022; Wang & Xu, 2024). Conversely, tourism development may stimulate further digital transformation by increasing demand for digital services, technological applications, and online business platforms (Zhao et al., 2023). These findings indicate that the digital economy and rural tourism development may function as interconnected systems characterized by mutual influence and co-evolution. Understanding the nature and extent of this interaction is important for promoting sustainable rural development and achieving the objectives of rural revitalization.

Despite growing scholarly attention to digital transformation and tourism development, important research gaps remain. First, most existing studies focus on the direct impact of digital technologies on tourism performance, while relatively limited attention has been given to the coordinated interaction between the digital economy and rural tourism development (Yang et al., 2023; Liu & Chen, 2024). Second, many studies are confined to specific provinces, cities, or tourism destinations, limiting understanding of broader regional patterns and national-level dynamics. Third, considerable regional disparities exist across Chinese provinces with respect to economic development, digital infrastructure, investment capacity, and tourism resource endowments, suggesting that the relationship between digital economy development and rural tourism development may vary substantially across regions (Huang et al., 2024). However, empirical evidence regarding such spatial heterogeneity remains limited.

To address these gaps, this study is anchored on Coupling Coordination Theory, which posits that sustainable development depends not only on the growth of individual systems but also on the degree of harmonious interaction among interconnected systems (Wang et al., 2021). Within this framework, the digital economy and rural tourism development are conceptualized as two interdependent subsystems whose interactions may generate varying levels of coordinated development. The digital economy subsystem comprises digital infrastructure, digital industry development, and digital inclusive finance, while the rural tourism development subsystem consists of environmental, economic, and social dimensions. The theory suggests that improvements in one subsystem can positively influence the development of the other, thereby creating synergistic effects that contribute to broader rural development outcomes.

Conceptually, the study assumes that digital economy development enhances rural tourism development by improving connectivity, facilitating information exchange, expanding financial accessibility, and supporting technological innovation. In turn, the growth of rural tourism creates demand for digital services, online platforms, electronic payment systems, and smart management technologies, thereby reinforcing digital economy development. The degree of coordination between these systems may vary according to regional characteristics such as geographic location, fixed-asset investment levels, and natural resource endowments. Consequently, stronger coupling coordination between the digital economy and rural tourism development is expected to contribute to rural revitalization and sustainable regional development.

Guided by this framework, the study sought to answer the following research questions:

1. What are the characteristics of digital economy development among Chinese provinces from 2020 to 2024?
2. What are the characteristics of rural tourism development among Chinese provinces from 2020 to 2024?
3. Are there significant differences in digital economy development and rural tourism development when provinces are grouped according to geographic location, fixed-asset investment levels, and natural resource endowments?
4. What is the degree of coupling coordination between the digital economy and rural tourism development across Chinese provinces from 2020 to 2024?
5. How does coupling coordination vary across regions with different geographic, investment, and resource characteristics?

Specifically, the study aimed to:

1. Describe the characteristics of digital economy development among Chinese provinces from 2020 to 2024.
2. Describe the characteristics of rural tourism development among Chinese provinces from 2020 to 2024.
3. Determine whether significant regional differences exist in digital economy development and rural tourism development according to geographic location, fixed-asset investment levels, and natural resource endowments.
4. Assess the degree of coupling coordination between the digital economy and rural tourism development.
5. Examine the spatial heterogeneity of coupling coordination across provinces with different regional characteristics.

By examining the interaction between the digital economy and rural tourism development across 30 Chinese provinces, this study contributes to the growing literature on digital transformation, rural revitalization, and sustainable tourism development. The findings are expected to provide empirical evidence that can assist policymakers in designing region-specific strategies that integrate digital transformation and tourism development to promote balanced regional growth and long-term rural revitalization.

REVIEW OF RELATED LITERATURE

The digital economy has become a critical driver of regional economic transformation, innovation, and competitiveness. Recent studies indicate that investments in digital infrastructure, digital industries, and digital financial services contribute significantly to productivity growth and economic modernization by facilitating information exchange, reducing transaction costs, and improving resource allocation efficiency (Wang et al., 2022; Liu & Zhang, 2023). The expansion of broadband networks, cloud computing, artificial intelligence, and digital platforms has accelerated the integration of traditional industries with emerging technologies, thereby promoting new forms of economic activity and value creation (Chen et al., 2024).

In rural areas, digital transformation has played an increasingly important role in overcoming geographical constraints and development barriers. Empirical evidence suggests that digital infrastructure enhances access to markets, information, and public services, thereby improving economic opportunities and household welfare (Yang et al., 2023). Similarly, digital inclusive finance has expanded financial accessibility among underserved populations, enabling rural entrepreneurs and small enterprises to participate more actively in economic activities (Guo et al., 2023). Studies further demonstrate that digital economy development contributes positively to agricultural modernization, industrial upgrading, and rural revitalization by strengthening innovation capacity and improving connectivity between rural and urban economies (Li et al., 2024).

Despite these benefits, digital development remains uneven across regions. Significant disparities persist in terms of infrastructure quality, technological capabilities, investment levels, and human capital availability (Huang et al., 2024). Economically advanced provinces generally exhibit higher levels of digital economy development than less-developed regions, resulting in unequal access to digital opportunities and benefits. Such regional disparities suggest that the developmental impacts of the digital economy may vary considerably across provinces, highlighting the importance of examining spatial differences in digital transformation outcomes.

Rural Tourism Development and Rural Revitalization

Rural tourism has become an increasingly important strategy for promoting sustainable rural development and revitalization. As a multifaceted development approach, rural tourism contributes to employment generation, income diversification, cultural preservation, environmental conservation, and community development (Sun et al., 2023; Zhao & Wang, 2024). The growing demand for authentic cultural experiences, ecological tourism, and nature-based recreation has created significant opportunities for rural destinations to participate in the broader tourism economy.

Recent studies emphasize the multidimensional nature of rural tourism development, which encompasses environmental, economic, and social dimensions. Environmentally sustainable tourism practices contribute to the conservation of natural landscapes and ecological resources while enhancing destination attractiveness (Liu et al., 2022). Economically, rural tourism generates employment opportunities, stimulates local entrepreneurship, and increases household incomes (Chen & Xu, 2023). Socially, tourism development supports cultural preservation, strengthens community participation, and improves quality of life for rural residents (Yang et al., 2024).

Within the Chinese context, rural tourism has become an important component of the Rural Revitalization Strategy. Government investments in transportation infrastructure, tourism facilities, cultural heritage preservation, and destination development have contributed to the rapid expansion of rural tourism across many provinces (Zhang et al., 2023). However, several challenges continue to affect sustainable tourism development, including uneven regional growth, environmental pressures, seasonal demand fluctuations, and disparities in resource endowments (Wang et al., 2024). These challenges underscore the need for innovative approaches that enhance the sustainability and competitiveness of rural tourism destinations.

Coupling Coordination Studies

Coupling Coordination Theory has been widely adopted in regional development research to examine interactions among economic, social, environmental, and technological systems. The theory provides a useful framework for evaluating whether multiple systems develop in a mutually reinforcing and balanced manner (Wang et al., 2021). In recent years, the Coupling Coordination Degree Model (CCDM) has become an increasingly popular analytical tool for assessing relationships among complex development systems.

Previous studies have applied coupling coordination analysis to various research contexts, including urbanization and ecological sustainability, economic development and environmental protection, technological innovation and industrial upgrading, and tourism development and environmental management (Liu et al., 2023; Chen et al., 2024). Findings generally indicate that coordinated development among interconnected systems contributes to improved sustainability and long-term development outcomes.

More recently, scholars have begun exploring the relationship between digital economy development and other socio-economic systems using coupling coordination approaches. Existing studies suggest that digital transformation can facilitate coordinated regional development by improving efficiency, innovation, and connectivity (Zhao et al., 2023). However, the application of coupling coordination models to the relationship between the digital economy and rural tourism development remains relatively limited. Most studies focus either on tourism development or digital economy development independently, with fewer investigations examining the reciprocal interactions between these systems.

Furthermore, previous coupling coordination studies frequently concentrate on specific provinces or regions, limiting understanding of broader national patterns. As a result, there remains a need for comprehensive provincial-level analyses that assess the coordinated development of the digital economy and rural tourism across diverse regional contexts.

Spatial Heterogeneity and Regional Differences

Spatial heterogeneity has emerged as an important consideration in studies of regional development. China's vast geographic size, diverse resource endowments, varying levels of economic development, and uneven infrastructure distribution contribute to significant regional disparities in development outcomes (Huang et al., 2024). These differences influence not only economic performance but also the effectiveness of development policies and technological interventions.

Recent studies demonstrate that the impacts of digital economy development vary across regions due to differences in institutional environments, infrastructure quality, human capital, and investment capacity (Li & Zhao, 2023). Similarly, tourism development outcomes are strongly influenced by geographic location, accessibility, natural attractions, and cultural resources (Sun et al., 2024). Provinces endowed with stronger economic foundations and richer tourism resources often achieve higher levels of tourism competitiveness and development.

Research on spatial heterogeneity further indicates that regional characteristics may influence the degree of coordination among development systems. Geographic location affects market accessibility and infrastructure development, while fixed-asset investment influences economic capacity and technological adoption. Natural resource endowments likewise shape tourism attractiveness and development potential (Wang et al., 2023). Understanding how these factors influence the relationship between the digital economy and rural tourism development is therefore essential for designing effective region-specific development strategies.

Synthesis and Research Gap

The literature demonstrates that both the digital economy and rural tourism development play important roles in promoting sustainable rural development and regional revitalization. Existing studies consistently report positive effects of digital transformation on economic growth, innovation, financial inclusion, and tourism development. Likewise, rural tourism has been recognized as an effective mechanism for employment generation, income diversification, and community development.

However, several gaps remain in the existing literature. First, much of the current research focuses on direct causal relationships between digital technologies and tourism outcomes, while limited attention has been devoted to examining the coordinated interaction between the digital economy and rural tourism development as interconnected systems. Second, many studies are conducted at local or regional levels, limiting understanding of national-level patterns and dynamics. Third, insufficient attention has been given to spatial heterogeneity and the role of regional characteristics in shaping the coordination between these systems.

To address these gaps, the present study examines the coupling coordination relationship between the digital economy and rural tourism development across 30 Chinese provinces from 2020 to 2024. By incorporating geographic location, fixed-asset investment levels, and natural resource endowments into the analysis, the study provides a more comprehensive understanding of how digital transformation contributes to rural tourism development and rural revitalization within diverse regional contexts.

RESULTS AND DISCUSSION

For the journal article, this section should be condensed into approximately 3–4 pages and organized under:

Characteristics of the Digital Economy

The digital economy exhibited a continuous upward trend during the study period. Digital infrastructure and digital inclusive finance demonstrated the strongest growth, indicating substantial progress in digital connectivity and financial accessibility across Chinese provinces. However, digital industry development lagged behind other dimensions, suggesting uneven progress within the digital economy subsystem.

Characteristics of Rural Tourism Development

Rural tourism development also improved between 2020 and 2024. Economic indicators contributed most strongly to overall growth, while environmental and social dimensions showed comparatively slower progress. This pattern suggests that tourism expansion has been driven primarily by economic factors rather than balanced sustainable development.

Regional Differences

Significant differences were observed among provinces based on geographic location, fixed-asset investment levels, and natural resource endowments. Provinces located in economically advanced regions generally demonstrated stronger digital economy performance and higher levels of tourism development.

Coupling Coordination Analysis

The relationship between the digital economy and rural tourism development strengthened steadily throughout the study period. Although the systems demonstrated increasing interaction, overall coordination remained in a transitional stage, progressing from moderate imbalance toward basic coordination by 2024.

Spatial Heterogeneity

Geographic location emerged as the most important source of variation in coupling coordination. This finding highlights the importance of regional context in shaping the effectiveness of digital transformation as a driver of rural tourism development.

CONCLUSION

The study demonstrates that the digital economy and rural tourism development are increasingly interconnected systems that contribute jointly to rural revitalization in China. While both systems exhibited positive growth during the study period, substantial regional disparities remain. The findings indicate that digital transformation serves as an important catalyst for rural tourism development, yet the degree of coordination varies significantly across provinces. Policymakers should therefore adopt region-specific strategies that integrate digital infrastructure investment, tourism innovation, and sustainable development objectives to promote balanced regional growth and long-term rural revitalization.

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