The Impact of New Quality Productive Forces on the High-Quality Development of China' s Tourism Economy: A Postprint

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Abstract

New quality productive forces serve as a crucial support for achieving high-quality development and provide a new impetus for the high-quality development of China' s tourism economy. Focusing on new quality productive forces and the high-quality development of the tourism economy, this study utilizes panel data from 30 provinces (autonomous regions and municipalities) in China (excluding Tibet, Hong Kong, Macao, and Taiwan) from 2012 to 2022. By constructing an indicator system for new quality productive forces and the level of high-quality development of the tourism economy, the study empirically analyzes the internal mechanisms and spatial effects of new quality productive forces in driving the high-quality development of the tourism economy.

The results indicate that: (1) New quality productive forces can significantly promote the high-quality development of China' s tourism economy, though this promotion effect exhibits regional heterogeneity. Specifically, there is a significant positive promotion effect in the eastern and western regions, with the effect in the western region being greater than that in the eastern region, while the promotion effect in the central and northeastern regions is not significant. (2) Industrial structure upgrading and the level of marketization are key mediating paths through which new quality productive forces influence the high-quality development of the tourism economy, with the contribution of industrial structure upgrading to the high-quality development of the tourism economy being more significant. The research findings provide data support for relevant theoretical research and offer theoretical guidance for advancing the high-quality development of the tourism economy.

Full Text

Preamble

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GEOGRAPHY

The Impact of New Quality Productive Forces on the High-Quality Development of China' s Tourism Economy

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Abstract

As China enters a new era of economic transformation, the concept of "new quality productive forces" has emerged as a critical driver for industrial upgrading. This paper explores the theoretical mechanisms and empirical impact of new quality productive forces on the high-quality development of China' s tourism economy. By integrating technological innovation, green development, and digital transformation, new quality productive forces provide a novel impetus for optimizing the tourism industrial structure and enhancing service efficiency. Through a systematic analysis of regional data, this study examines how these forces reshape the tourism landscape, fostering a more sustainable, efficient, and value-driven economic model.

1. Introduction

The development of the tourism economy is a vital component of China' s national strategy for high-quality growth. In recent years, the traditional growth model of the tourism industry, which relied heavily on resource consumption and scale expansion, has faced significant challenges. To achieve sustainable and high-quality development, it is essential to transition toward a model driven by innovation and efficiency. The emergence of "new quality productive forces" —characterized by high technology, high efficiency, and high quality—offers a strategic pathway for this transformation.

New quality productive forces represent a departure from traditional labor-intensive and resource-heavy production methods. In the context of the tourism economy, these forces manifest through the application of artificial intelligence, big data, and green technologies, which collectively enhance the traveler experience and operational management. This paper aims to analyze the internal

logic of how these forces influence tourism development and to provide empirical evidence for their role in promoting economic resilience and environmental sustainability within the sector.

2. Theoretical Framework and Research Hypotheses

2.1 The Concept of New Quality Productive Forces in Tourism

New quality productive forces are defined by their reliance on scientific and technological innovation as the core driving factor. In the tourism sector, this involves the integration of the digital economy with physical tourism assets. Unlike traditional productive forces, new quality productive forces emphasize the "quality"aspect, focusing on the optimization of the total factor productivity (TFP) of the tourism industry.

2.2 Mechanism of Impact

The impact of new quality productive forces on tourism development can be categorized into three primary dimensions:

1. **Technological Empowerment:** The adoption of smart tourism technologies, such

1. Introduction

In recent years, the rapid development of machine learning and deep learning has revolutionized various scientific and engineering disciplines. These computational frameworks have demonstrated remarkable efficacy in processing high-dimensional data, identifying complex patterns, and providing predictive insights that were previously unattainable through traditional analytical methods.

[Figure 1: see original paper]

The integration of these advanced algorithms into experimental and theoretical workflows has enabled researchers to bridge the gap between empirical observations and fundamental physical laws. By leveraging large-scale datasets, deep learning models can approximate non-linear functions with high precision, making them indispensable tools for modeling intricate systems.

Furthermore, the application of these techniques extends beyond simple data classification. In the context of physical sciences, machine learning is increasingly utilized to accelerate simulations, optimize experimental parameters, and discover novel materials. This shift toward data-driven discovery represents a significant paradigm shift in the modern scientific landscape.

1. Introduction

In recent years, the rapid development of machine learning and deep learning has significantly transformed various scientific and engineering disciplines. These

computational techniques have demonstrated remarkable efficacy in processing high-dimensional data, identifying complex patterns, and generating predictive models with high accuracy. Particularly in fields such as computer vision, natural language processing, and bioinformatics, deep learning architectures have surpassed traditional statistical methods, enabling breakthroughs in tasks that were previously considered computationally intractable.

The integration of these advanced algorithms into experimental and theoretical frameworks has facilitated a new paradigm of data-driven discovery. By leveraging large-scale datasets, researchers can now extract meaningful insights and establish correlations that govern physical phenomena without relying solely on explicit analytical derivations. This shift towards hybrid modeling—combining domain-specific knowledge with flexible neural network structures—represents a critical frontier in modern research.

Despite these advancements, several challenges remain, particularly regarding the interpretability and robustness of deep learning models in sensitive applications. The "black-box" nature of many high-performing architectures often obscures the underlying decision-making process, necessitating the development of explainable AI (XAI) techniques. Furthermore, ensuring that models generalize well across diverse datasets and remain resilient to adversarial perturbations is essential for their deployment in real-world scenarios. This paper explores these themes, proposing novel methodologies to enhance both the performance and the transparency of machine learning frameworks in specialized domains.

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摘要

New quality productive forces serve as a critical foundation for achieving high-quality development, providing a novel impetus for the high-quality evolution of China' s tourism economy.

Focusing on the relationship between new quality productive forces and the high-quality development of the tourism economy, this study utilizes panel data from 30 provinces (autonomous regions and municipalities) in China—excluding Tibet, Hong Kong, Macao, and Taiwan—spanning the period from 2012 to 2022. By constructing a comprehensive indicator system for both new quality productive forces and the level of high-quality development in the tourism economy, this research conducts an empirical analysis.

This study analyzes the internal mechanisms and spatial effects of new quality productive forces in driving the high-quality development of the tourism economy. The results demonstrate the following:

(1) New quality productive forces significantly promote the high-quality development of China' s tourism economy. However, this promotional effect exhibits regional heterogeneity: it is significantly positive in the Eastern and Western regions—with a stronger impact observed in the West than

in the East—while the effects in the Central and Northeastern regions are not statistically significant.

(2) Industrial structure upgrading and marketization levels serve as critical mediating pathways through which new quality productive forces influence the high-quality development of the tourism economy. Among these, the contribution of industrial structure upgrading to the high-quality development of the tourism economy is more pronounced.

The findings of this research provide empirical data to support relevant theoretical studies and offer theoretical guidance for advancing the high-quality development of the tourism economy.

Keywords: New quality productive forces; High-quality development of the tourism economy; Industrial structure upgrading; Marketization
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Introduction

The concept of "new quality productive forces" represents a significant theoretical innovation in the context of China' s transition toward high-quality economic development. As the tourism industry undergoes a profound transformation from traditional resource-driven growth to innovation-led development, understanding the role of these new productive forces becomes essential. High-quality development of the tourism economy is no longer solely dependent on the quantity of tourists or basic infrastructure; rather, it increasingly relies on technological integration, green transitions, and the optimization of industrial structures.

The development of new quality productive forces is characterized by high technology, high efficiency, and high quality, aligning perfectly with the requirements for modernizing the tourism sector. By leveraging digital technologies, artificial intelligence, and sustainable practices, the tourism industry can enhance its value proposition and operational efficiency. This paper aims to explore the mechanisms through which new quality productive forces drive the high-quality development of the tourism economy, while considering the mediating role of industrial structure upgrading and the moderating effect of marketization levels.

Theoretical Framework and Research Hypotheses

The Direct Impact of New Quality Productive Forces on Tourism Development

New quality productive forces act as a primary catalyst for the tourism economy by fostering innovation in tourism products and services. The integration of advanced technologies allows for the creation of immersive experiences, personalized travel itineraries, and smarter management systems. These advancements lead to increased productivity and a more resilient tourism market. Furthermore,

the emphasis on "green" productive forces ensures that tourism development remains ecologically sustainable, preserving the natural and cultural assets that form the foundation of the industry.

The Mediating Role of Industrial Structure Upgrading

Industrial structure upgrading serves as a critical bridge between new quality productive forces and tourism growth. As technological innovations permeate the sector, they trigger a shift from traditional, low-value-added services to high-value-added, knowledge-intensive tourism activities. This structural optimization enhances the overall competitiveness of the tourism economy. By reallocating resources toward more efficient and innovative sub-sectors, the industry can achieve a more balanced and sustainable growth trajectory.

The Moderating Effect of Marketization

The impact of new quality productive forces is not uniform across all regions

New quality productive forces are driven by revolutionary technological breakthroughs, the innovative allocation of production factors, and the profound transformation and upgrading of industries. With the integration of labor, subjects of labor, and instruments of labor as its core components, and the substantial increase in total factor productivity as its primary indicator, its essence lies in advanced productivity characterized by innovation, high quality, and high efficiency.

In the context of the digital economy, the rapid development of cutting-edge technologies—such as artificial intelligence, big data, and cloud computing—has fundamentally reshaped traditional production models. These advancements have facilitated the emergence of new quality productive forces by enabling more precise resource allocation and fostering the growth of strategic emerging industries and future-oriented sectors. Unlike traditional growth models that rely on extensive resource consumption, new quality productive forces emphasize the leading role of scientific and technological innovation in driving sustainable and high-quality economic development.

The challenges currently faced and the inevitable choice to promote the high-quality development of the tourism economy.

advanced productivity spawned by innovative configurations and the profound transformation and upgrading of industries

Existing literature reveals the impact of new quality productive forces on high-quality tourism development from a multidimensional perspective.

The qualitative state refers to the organic integration and optimized combination of laborers, instruments of labor, and subjects of labor.

Introduction

···the promoting role of quality development. Li Xinjian et al. [**?**] analyzed the environmental context, spatial···

leap [1]. During the 2024 National Two Sessions, General Secretary Xi Jinping emphasized

Analyzing from multiple perspectives, including industrial formats and spatial dynamics, it is found that new quality productive forces can significantly enhance economic resilience and drive high-quality development. By fostering innovation-led growth, these forces facilitate the transformation of traditional industries while nurturing emerging strategic sectors. The integration of advanced technologies with physical production processes optimizes resource allocation and strengthens the structural stability of the industrial ecosystem. Furthermore, the evolution of new quality productive forces promotes the optimization of regional economic layouts, ensuring that industrial upgrading is both sustainable and adaptable to global market shifts.

We must firmly grasp the primary task of high-quality development and promote the growth of new quality productive forces by adapting measures to local conditions.

By reducing costs, improving service quality, and optimizing industrial supply, the system aims to enhance overall efficiency.

Introduction

The development of new quality productive forces represents an intrinsic requirement for achieving high-quality development. As a transformative concept in modern economic theory, new quality productive forces signify a departure from traditional growth models, shifting the focus toward innovation-driven progress, structural optimization, and the enhancement of total factor productivity. This evolution is essential for fostering a resilient and sustainable economic ecosystem that can adapt to the complexities of the global technological landscape.

methods to promote the high-quality development of tourism; Feng Xuegang et al. [**?**] analyzed the relationship between the two···

Introduction

The requirements and critical focus areas [1] demonstrate that by accelerating production transformation and promoting the deep integration of digital technologies with the real economy, we can effectively foster new quality productive forces. As a core driving force of the current technological revolution, machine learning and deep learning have become essential tools for optimizing industrial processes and enhancing economic efficiency.

[Figure 1: see original paper]

The transition toward intelligent systems necessitates a comprehensive restructuring of traditional manufacturing paradigms. By leveraging advanced algorithms, industries can achieve higher levels of precision and adaptability. This evolution is not merely a technical upgrade but a fundamental shift in how value is created and distributed across global supply chains.

Furthermore, the strategic implementation of these technologies allows for the mitigation of systemic risks and the optimization of resource allocation. As outlined in recent policy frameworks, the synergy between algorithmic innovation and industrial application serves as the cornerstone for sustainable economic growth in the digital era. This approach ensures that the development of new quality productive forces remains aligned with both market demands and long-term strategic objectives.

Based on the consistency of internal connotations, we examine the development of the industry through the dual lenses of new technologies and new production factors.

1. Technological Innovation and Industrial Transformation

The rapid evolution of machine learning and deep learning has fundamentally reshaped the landscape of modern industry. By integrating these advanced computational paradigms, traditional sectors are undergoing a profound digital transformation. This shift is not merely a quantitative increase in efficiency but a qualitative change in how value is created and distributed. The application of sophisticated algorithms allows for the processing of vast datasets, enabling more precise predictive modeling and autonomous decision-making processes.

[Figure 1: see original paper]

2. New Production Factors in the Digital Era

In the context of the modern economy, data has emerged as a critical new factor of production, standing alongside traditional inputs such as labor and capital. The ability to harness and analyze data effectively determines the competitive advantage of an enterprise. As we transition toward a more data-centric model, the synergy between human expertise and algorithmic intelligence becomes paramount. This integration facilitates the optimization of resource allocation and the discovery of novel market opportunities that were previously inaccessible.

3. Methodological Framework

To quantify these shifts, we employ a rigorous mathematical framework to model the interaction between technological inputs and industrial output. Let $\mathcal{F}$ represent the production function, where the relationship between traditional capital K, labor L, and the new technological factor T is defined. We consider the

impact of a specific innovation $\bar{b}$ on the overall system efficiency. The evolution of the system state x over time can be expressed as:

$$\frac{dx}{dt} = \alpha K_{ab} + \beta L_{ij} + \gamma \mathcal{F}(T, \phi)$$

where ϕ represents the integration coefficient of deep learning models within the production chain. As noted in [**?**], the convergence of these factors leads to a nonlinear increase in total factor productivity. By applying the transformation $\tilde{x}$, we can further isolate the specific contributions of machine learning components to the structural stability of the industry, as shown in (eq:1).

4. Conclusion

The alignment of internal connotations across different industrial dimensions provides a robust foundation for understanding current economic trends. By focusing on the interplay between new technologies and emerging production factors, we can better predict the trajectory of global industrial evolution

The process of industrial upgrading and the provision of new fundamental elements of productivity serve as key mechanisms for empowerment.

The Driving Forces of New Quality Productive Forces in Promoting High-Quality Tourism Development

The emergence of new quality productive forces represents a significant shift in the economic landscape, providing a robust impetus for the high-quality development of the tourism industry. This transformation is driven by several key factors that integrate advanced technology, optimized resource allocation, and innovative business models.

Technological Innovation as the Core Engine

At the heart of new quality productive forces lies continuous technological innovation. In the context of tourism, the integration of deep learning, big data analytics, and the Internet of Things (IoT) has revolutionized how services are delivered and experienced. These technologies enable the creation of "smart tourism" ecosystems where data-driven insights allow for personalized travel recommendations and optimized flow management. By leveraging machine learning algorithms, tourism providers can predict market trends with higher accuracy, thereby reducing operational inefficiencies and enhancing the overall value proposition for travelers.

Optimization of Factor Productivity

New quality productive forces emphasize a departure from traditional, labor-intensive growth models toward those defined by high efficiency and sustain-

ability. This transition involves the sophisticated reconfiguration of traditional production factors—land, labor, and capital—through digital integration. For instance, the application of digital twin technology in heritage site management allows for the simultaneous preservation of cultural assets and the enhancement of visitor engagement. This optimization ensures that tourism growth is not merely quantitative but qualitative, characterized by higher value-added services and reduced environmental impact.

Structural Transformation and Industrial Upgrading

The infusion of new quality productive forces facilitates a structural shift within the tourism sector, encouraging the birth of novel business forms such as immersive digital exhibitions, virtual reality (VR) trekking, and AI-augmented hospitality. These innovations break the physical constraints of traditional tourism, expanding the industry' s boundaries and creating new consumption scenarios. As the industry moves up the value chain, the focus shifts from mass tourism to niche, high-quality experiences that prioritize cultural depth and emotional resonance.

Sustainability and Green Development

A fundamental characteristic of new quality productive forces is their alignment with green development goals. High-quality tourism development necessitates a symbiotic relationship between economic gain and ecological preservation. By utilizing advanced energy-saving technologies and circular economy principles, the tourism industry can significantly lower its carbon footprint. The drive toward "green productivity" ensures that the natural and cultural resources upon which tourism depends are preserved for future generations, making sustainability a competitive advantage rather than a constraint.

In conclusion, the driving forces of new quality productive forces—ranging from technological breakthroughs to structural optimization and green transitions

High-quality development.

mechanisms; Yang Jianchun et al. [**?**] analyzed the subject from the perspective of the constituent elements of productivity.

Introduction

The tourism economy serves as a vital pathway for implementing new development concepts and the "Two Mountains" theory (the idea that lucid waters and lush mountains are invaluable assets). It plays a crucial role in promoting high-quality regional development and achieving common prosperity. As a strategic pillar industry of the national economy, the tourism sector' s transition toward green, low-carbon, and sustainable development has become a core focus of academic research and policy formulation.

In recent years, the integration of the digital economy with traditional tourism has accelerated, leading to significant structural transformations. By leveraging advanced technologies such as big data, artificial intelligence, and cloud computing, the tourism industry has enhanced its resource allocation efficiency and reduced environmental impacts. This digital transformation not only optimizes the supply side of tourism services but also reshapes consumer behavior, fostering a more resilient and environmentally conscious economic model.

Furthermore, the spatial evolution of the tourism economy exhibits complex characteristics. Regional disparities in infrastructure, natural resource endowments, and policy support have led to a heterogeneous landscape of tourism development. Understanding the coupling coordination between tourism growth and ecological preservation is essential for ensuring long-term sustainability. Consequently, analyzing the driving factors and spatial spillover effects of the tourism economy provides a scientific basis for optimizing regional industrial layouts and advancing ecological civilization.

The Impact of New Quality Productive Forces on the High-Quality Development of Tourism: A Review of Existing Research

The concept of "New Quality Productive Forces" represents a significant theoretical innovation in contemporary economic discourse, providing a new engine and directional guidance for the high-quality development of various industries, particularly tourism. Existing academic research primarily focuses on the theoretical logic, internal mechanisms, and empirical pathways through which these forces transform the tourism landscape.

1. Theoretical Logic and Connotation

Scholars generally agree that new quality productive forces in the tourism sector are characterized by "innovation as the lead, high quality as the key, and advanced productivity as the essence." Unlike traditional tourism development models that rely heavily on labor-intensive services and natural resource consumption, new quality productive forces emphasize the integration of disruptive technological innovations. This involves the deep application of digital technologies—such as Big Data, Artificial Intelligence (AI), and Blockchain—to optimize the allocation of tourism production factors. Research suggests that these forces redefine the relationship between "man and nature" and "man and technology" within tourism, shifting the industry from a scale-driven expansion to a value-driven intensification.

2. Mechanisms of Impact on High-Quality Tourism Development

Existing literature identifies several key channels through which new quality productive forces drive high-quality development in tourism:

- **Digital Transformation and Intelligence:** The application of smart tourism systems enhances the efficiency of resource management and improves the tourist experience. Through $TFP = \mathcal{F}(K, L, D)$, researchers have modeled how data-driven decision-making reduces information asymmetry between tourists and service providers, leading to more personalized and high-value service delivery.
- **Green Development and Sustainability:** New quality productive forces are inherently "green." Studies indicate that technological advancements in energy efficiency and waste management within hotels and scenic spots contribute to the "dual carbon" goals. This alignment ensures that tourism development does not come at the expense of ecological integrity, fulfilling the requirements for sustainable high-quality growth.
- **Industrial Convergence and Structural Upgrading:** The infusion of new productive forces facilitates the "Tourism+" phenomenon, where tourism merges with agriculture, industry, and culture. This cross-sectoral integration creates new consumption scenarios and business models (such as immersive digital exhibitions and smart rural tourism), effectively upgrading the industrial structure.

3. Empirical Evidence and Measurement

Recent empirical studies have attempted to quantify the impact of new quality productive forces using various econometric models. Researchers often employ the Total Factor Productivity

Improving people' s living standards is a vital pathway toward expanding domestic demand and stimulating consumption.

Research indicates that new quality productive forces can drive high-quality economic development through cost reduction, efficiency enhancement, and resource innovation.

It plays an irreplaceable role in reducing costs, enhancing efficiency, and promoting the integrated development of industries.

Quality improvement and other strategic pathways drive the high-quality development of the tourism economy.

However, during its development, the tourism economy faces significant challenges regarding industrial innovation and structural optimization. As a pillar industry for many regional economies, tourism is increasingly reliant on technological integration to maintain its growth momentum. The role of digital transformation, particularly through the application of machine learning and deep learning, has become a critical factor in enhancing the efficiency of resource allocation within the sector.

Despite its potential, the tourism economy often encounters bottlenecks in traditional service models and infrastructure. These limitations necessitate a transition toward more intelligent, data-driven strategies. By leveraging advanced

analytical tools, stakeholders can better understand consumer behavior and market trends, thereby fostering a more resilient and innovative industrial ecosystem. This evolution is essential for addressing the complexities of modern global travel demands and ensuring long-term sustainable development.

In summary, existing literature has conducted extensive research and exploration regarding the environmental background, conceptual connotations, and developmental logic of the digital economy. However, as a new economic form, the digital economy is still in a stage of rapid evolution, and its impact on the high-quality development of the manufacturing industry remains a frontier issue that requires further investigation.

Current studies primarily focus on the macro-level impact of digital technology on industrial structure upgrading and economic growth. Yet, there is a relative lack of micro-level analysis concerning how digital transformation specifically reshapes the production processes, organizational structures, and value creation mechanisms of manufacturing enterprises. Furthermore, while the theoretical framework for the digital economy' s role in enhancing manufacturing efficiency is gradually taking shape, empirical evidence regarding the non-linear effects and spatial spillover characteristics of this relationship is still insufficient.

Therefore, it is necessary to systematically analyze the internal mechanisms by which the digital economy drives the transformation and upgrading of the manufacturing industry. This includes exploring the mediating roles of technological innovation and resource allocation efficiency, as well as the moderating effects of institutional environments and human capital. By addressing these gaps, we can provide a more robust theoretical basis and practical guidance for promoting the deep integration of the digital economy with the real economy, ultimately achieving high-quality industrial development.

Weak innovation capabilities, unbalanced regional development, and a shortage of professional tourism talent.

1. The Internal Logic of New Quality Productive Forces and High-Quality Tourism Development

The core of developing new quality productive forces lies in the leap of productivity elements, while the essence of high-quality development in the tourism economy is the transition from "scale expansion" to "quality and efficiency enhancement." From the perspective of constituent elements, the synergy between these two is reflected in the following three dimensions:

1.1 Laborers: From Traditional Service Personnel to High-Tech Talent

New quality productive forces require a new type of laborer who possesses modern technical skills and innovative capabilities. In the context of the tourism economy, this manifests as a shift from traditional labor-intensive service roles

to composite talents who understand both tourism operations and digital technologies (such as Big Data analysis, AI-driven marketing, and smart destination management). These high-quality laborers are the primary drivers for optimizing tourism supply and enhancing the tourist experience.

1.2 Labor Means: From Conventional Facilities to Intelligent Tools

The "newness" of new quality productive forces is most evident in the revolutionary transformation of labor means. In the tourism sector, traditional labor means like physical travel agencies and paper maps are being replaced by "new labor means" such as 5G, the Internet of Things (IoT), and Virtual Reality (VR). These technologies enable the digitalization of tourism scenes and the intelligence of management processes, providing the technical infrastructure necessary for high-quality development.

1.3 Objects of Labor: From Physical Resources to Data and Virtual Spaces

Traditionally, the objects of labor in tourism were primarily physical landscapes and cultural relics. Under the influence of new quality productive forces, the scope of labor objects has expanded significantly. Data has become a core production factor; by mining and analyzing massive amounts of behavioral data, tourism enterprises can achieve precise marketing and personalized service customization. Furthermore, the rise of the "Metaverse" and digital twins has transformed virtual spaces into new objects of tourism labor, breaking the physical constraints of traditional tourism.

2. Path to High-Quality Development of the Tourism Economy

Driven by new quality productive forces, the high-quality development of the tourism economy should focus on the following paths:

- **Innovation-Driven Transformation:** Leveraging technological innovation to foster new business formats, such as immersive tourism and smart travel, thereby increasing the added value of the tourism industry.
- **Green and Sustainable Development:** Utilizing new energy and environmental technologies to promote "low-carbon tourism," ensuring that the development

New quality productive forces are capable of driving development through innovation and guiding progress through quality enhancement.

Research has been conducted on the development of these fields and the relationship between them; however, most existing studies remain at the theoretical level.

The collaborative development model provides an objective material foundation for the tourism industry.

At the analytical level, empirical tests based on large-sample data remain scarce.

and scientific guidance, it serves as a critical approach to addressing the challenges encountered during the development of the tourism industry in the new era.

The Causal Relationship Between New Quality Productive Forces and the High-Quality Development of the Tourism Economy

1. Introduction

In the current era of global economic transformation, the concept of "new quality productive forces"has emerged as a critical driver for structural optimization and sustainable growth. Characterized by innovation, digitalization, and green development, these forces represent a departure from traditional, labor-intensive growth models. Simultaneously, the tourism industry is undergoing a transition toward high-quality development, shifting its focus from mere quantitative expansion to qualitative enhancement. Understanding the causal relationship between new quality productive forces and the high-quality development of the tourism economy is essential for formulating effective regional policies and fostering industrial resilience.

2. Theoretical Framework and Mechanism Analysis

The impact of new quality productive forces on the tourism economy is multifaceted, involving technological, institutional, and environmental dimensions.

2.1 Technological Innovation as a Core Driver New quality productive forces are rooted in disruptive technological innovations. In the tourism sector, the integration of big data, artificial intelligence, and the Internet of Things (IoT) has revolutionized service delivery and consumer experiences. For instance, smart tourism platforms utilize $\mathcal{F}$ to optimize resource allocation, while virtual reality (VR) provides immersive previews of destinations. These advancements reduce information asymmetry and enhance the overall efficiency of the tourism value chain.

2.2 Green Development and Sustainability A defining characteristic of new quality productive forces is the emphasis on ecological civilization. High-quality tourism development requires a symbiotic relationship with the environment. By adopting green technologies and low-carbon management practices, the tourism industry can mitigate its environmental footprint. The transition toward "green productivity" ensures that tourism growth does not come at the

expense of natural capital, thereby aligning with the long-term goals of high-quality development.

2.3 Structural Optimization and Industrial Synergy The infusion of new quality productive forces facilitates the "tourism+" model, promoting the integration of tourism with agriculture, manufacturing, and cultural industries. This synergy creates new consumption scenarios and expands the boundaries of the tourism economy. As cited in [**?**], the cross-sectoral flow of production factors —such as high-end talent and digital capital—accelerates the modernization of the tourism service system.

3. Empirical Methodology

To rigorously examine the causal link, this study employs a multi-dimensional index system to measure both new quality productive forces and tourism quality.

3.1 Variable Selection and Data Sources and a rigorous verification of the underlying mechanisms, typically conducted from a global perspective.

The green consciousness and sense of identity among workers, as well as the utilization of labor capital for green innovation, are critical components of this transition. These factors collectively drive the organizational capacity to adopt and implement sustainable practices. By fostering an environment where employees align their personal values with the company' s environmental goals, firms can more effectively leverage human capital to achieve significant breakthroughs in green technology and resource efficiency.

Comparative Study of Regions with Different Infrastructure Construction and Economic Development Levels

1. Introduction

The relationship between infrastructure construction and economic development has long been a core focus of regional economics and development studies. Infrastructure, as the physical foundation of economic activity, plays a dual role: it serves as a direct driver of investment and as a critical facilitator of long-term productivity. However, the impact of infrastructure investment is not uniform across all regions. This study aims to conduct a comparative analysis of regions characterized by varying levels of infrastructure maturity and economic development to understand the mechanisms through which these factors interact.

2. Theoretical Framework and Literature Review

Economic theory suggests that infrastructure reduces transaction costs, enhances market integration, and promotes the efficient allocation of resources. According to the endogenous growth model, public capital—specifically in the

form of transportation, energy, and telecommunications—can significantly increase the marginal productivity of private capital.

Previous research, such as [**?**], has demonstrated that in developed regions, the focus often shifts from basic physical connectivity to high-tech digital infrastructure and sustainable energy systems. Conversely, in developing regions, the primary challenge remains the establishment of basic networks to overcome geographical barriers and integrate local markets into the national or global economy [**?**]. This study builds upon these theories by examining the "threshold effect," where the economic returns on infrastructure investment may vary depending on the existing level of development.

3. Methodology and Data Collection

To analyze these regional disparities, we utilize a multi-dimensional dataset spanning several decades. The data includes indicators of physical infrastructure (e.g., road density, railway mileage), digital infrastructure (e.g., broadband penetration, 5G coverage), and economic performance (e.g., GDP per capita, industrial output).

The methodology employs a panel data model to estimate the elasticity of economic growth with respect to infrastructure investment. We categorize the study areas into three distinct groups: 1. **High-Development Regions:** Characterized by saturated physical infrastructure and high GDP per capita. 2. **Transitioning Regions:** Characterized by rapid infrastructure expansion and moderate economic growth. 3. **Underdeveloped Regions:** Characterized by significant infrastructure deficits and lower economic output.

4. Comparative Analysis of Regional Patterns

4.1 High-Development Regions In regions with advanced economic status, the marginal utility of traditional infrastructure, such as highways, tends to diminish. As shown in [FIGURE:

The integration of advanced technologies and data-driven strategies is essential to promote the green development of the tourism industry.

research in this area remains limited. In light of this, the present study builds upon the foundation of existing theoretical research to address these gaps.

Based on this, this paper proposes the following hypotheses:

Based on data from 30 provinces (autonomous regions and municipalities) in China from 2012 to 2022, this study conducts an empirical analysis.

New quality productive forces exert a positive influence on the high-quality development of the tourism economy.

Empirical Analysis

This study utilizes panel data covering 31 provinces, autonomous regions, and municipalities in mainland China (excluding Tibet, Hong Kong, Macau, and Taiwan) to conduct an empirical analysis of the impact of new···

1.2.2 区域异质性分析不同地区的新质生产力发

The Impact of New Quality Productive Forces on the High-Quality Development of the Tourism Economy and Regional Heterogeneity

1. Introduction

In the current era of rapid technological advancement and economic transformation, the concept of "new quality productive forces" has emerged as a critical driver for industrial upgrading and sustainable growth. Characterized by innovation, digitalization, and green development, these forces are reshaping traditional economic structures. The tourism industry, as a pillar of the modern service economy, is undergoing a profound transition toward high-quality development. Understanding how new quality productive forces influence this transition is essential for optimizing resource allocation and fostering regional economic resilience.

2. Theoretical Framework and Research Hypotheses

The impact of new quality productive forces on the tourism economy is multifaceted. At its core, this influence is mediated through technological innovation, which enhances operational efficiency, and digital integration, which improves the consumer experience.

2.1 Direct Impact of New Quality Productive Forces New quality productive forces promote the high-quality development of the tourism economy by optimizing the supply side of tourism services. Through the application of big data, artificial intelligence, and the Internet of Things (IoT), tourism destinations can achieve precise marketing and intelligent management. This leads to a more efficient utilization of tourism resources and a reduction in operational costs.

2.2 The Mediating Role of Industrial Structure Upgrading The infusion of new quality productive forces facilitates the upgrading of the tourism industrial structure. By integrating with high-tech industries, tourism evolves from a traditional labor-intensive sector into a knowledge-intensive and technology-driven industry. This structural shift is a prerequisite for achieving long-term, high-quality economic growth in the tourism sector.

3. Research Design and Data Sources

To empirically test the relationship between new quality productive forces and the high-quality development of the tourism economy, this study employs a panel data model across various regions.

3.1 Variable Selection and Measurement The dependent variable, High-Quality Development of the Tourism Economy (HQD), is measured using a multi-dimensional index system encompassing economic benefit, social contribution, and ecological protection. The independent variable, New Quality Productive Forces (NQF), is quantified through indicators of technological innovation, digital infrastructure, and green productivity.

3.2 Model Specification We utilize a fixed-effects model to control for unobserved regional heterogeneity. The basic econometric model is specified as follows:

$$HQD = \alpha + \beta NQF + \gamma Control + \epsilon$$

The impact of tourism development on high-quality economic growth varies significantly across different regions, suggesting that its promotional effects are subject to regional heterogeneity. Depending on the specific level of regional development, the mechanisms through which tourism contributes to high-quality economic advancement may manifest differently.

qualitative, and further introduces industrial structure upgrading and marketization levels as···

significant differences. In terms of infrastructure construction, innovation system investment, and human capital development, there are notable disparities across regions. These factors play a critical role in shaping the overall capacity for technological advancement and economic growth. Furthermore, the allocation of resources within these sectors often reflects broader socio-economic priorities, leading to varied outcomes in regional competitiveness and long-term sustainability. Understanding these gaps is essential for formulating targeted policies that promote balanced regional development and enhance the efficiency of the national innovation ecosystem.

New Quality Productive Forces and the High-Quality Development of the Tourism Economy: The Mediating Role of Technological Innovation

Introduction

The concept of "new quality productive forces" represents a significant evolution in economic theory, emphasizing a shift from traditional labor-intensive growth to a model driven by high technology, high efficiency, and high quality. In the context of the modern service industry, the tourism economy is undergoing

a profound transformation. This paper explores how new quality productive forces act as a catalyst for the high-quality development of the tourism economy, specifically examining the critical mediating role played by technological innovation.

The Impact of New Quality Productive Forces on the Tourism Economy

New quality productive forces are characterized by the integration of advanced digital technologies, green development principles, and optimized resource allocation. When applied to the tourism sector, these forces redefine the traditional production function of tourism services. By replacing conventional, low-efficiency growth drivers with data-driven decision-making and intelligent infrastructure, new quality productive forces enhance the overall productivity of the tourism industry. This transition is not merely quantitative but qualitative, leading to more resilient, sustainable, and value-added tourism experiences.

[Figure 1: see original paper]

The Mediating Role of Technological Innovation

Technological innovation serves as the primary mechanism through which new quality productive forces are translated into high-quality tourism outcomes. This mediation occurs across several dimensions:

1. **Digital Transformation and Smart Tourism**: The application of $\mathbf{D}$ (where $\mathbf{D}$ represents the vector of digital integration) allows for the seamless connection between supply and demand. Through machine learning algorithms and big data analytics, tourism providers can predict consumer behavior with high precision, leading to personalized service delivery.
2. **Operational Efficiency**: Technological innovation optimizes the allocation of tourism resources. By utilizing $\mathcal{M}$ to model flow dynamics, destinations can mitigate over-tourism and enhance the visitor experience through real-time management systems.
3. **Product Innovation**: The emergence of Virtual Reality (VR), Augmented Reality (AR), and the Metaverse—driven by new quality productive forces—creates novel tourism products that transcend physical limitations, providing immersive cultural and historical education.

Promoting High-Quality Development

High-quality development in the tourism economy is defined by its sustainability, inclusivity, and economic efficiency. New quality productive forces promote these goals by fostering a "green"transition. Technological innovations in energy-saving transport and

Regions that lead in areas such as human resource reserves are better positioned to leverage the advantages of new technologies and innovations. These leading

regions possess a robust foundation for fostering high-quality development, as their concentration of skilled talent and intellectual capital facilitates the rapid adoption and integration of emerging industrial trends. Consequently, these areas are more likely to experience accelerated economic transformation and maintain a competitive edge in the global market.

···mechanisms of development, with the aim of providing empirical data support for relevant theoretical research.

the driving role of new quality productive forces in the high-quality development of the tourism economy [**?**]. The foundational

Contributing to the promotion of high-quality development in the tourism economy.

In regions with well-developed infrastructure, tourism enterprises can rapidly leverage new quality productive forces, such as the Internet of Things (IoT) and Artificial Intelligence (AI), to achieve the digital and intelligent transformation of tourism.

1 数据与方法

In regions with relatively mature innovation ecosystems, both government and corporate sectors invest heavily in scientific research and development. This robust investment provides a solid foundation for the innovation of tourism products driven by new quality productive forces.

1.1 数据来源及预处理

Based on the principles of data availability and continuity, this study selects 30 provinces (autonomous regions and municipalities) in China as the research sample, excluding Tibet, Hong Kong, Macao, and Taiwan.

The study utilizes panel data from 30 Chinese provinces (hereafter referred to as provinces) spanning an 11-year period from 2012 to 2022 as the research sample. The primary data sources include the *China Statistical Yearbook*, the *China Energy Statistical Yearbook*, and the *China Environment Statistical Yearbook*. Additional data were obtained from provincial and municipal statistical yearbooks, as well as various national economic and social development statistical bulletins. To ensure the continuity and scientific validity of the data, missing values for certain years in specific provinces were addressed using linear interpolation. All monetary variables were deflated to constant 2012 prices using the corresponding price indices to eliminate the influence of inflationary factors.

The data for this study are primarily derived from the *China Statistical Yearbook on Science and Technology*, the *China Statistical Yearbook on Culture, Relics, and Tourism*, and various provincial social development statistical bulletins. For instances where data points were missing, linear interpolation was employed to estimate the values and ensure the continuity of the dataset.

Abundant momentum is essential. Regarding the reserve of human resources, regions characterized by rich educational resources and strong talent appeal attract a significant number of top-tier professionals across various fields. These regions are capable of providing ample intellectual and technical support for the high-quality development of the tourism economy [**?**].

Based on this, the paper proposes the following hypothesis:

H2: New quality productive forces promote the high-quality development of the tourism economy.

interpolation method. Tourism revenue and per capita GDP are adjusted using 2012 as the base period.

The effects exhibit regional heterogeneity.

The variables were winsorized at the 1% level to mitigate the impact of extreme values. In this study, we employ the entropy weight method to determine the objective weights of the indicators, thereby ensuring a more rigorous and scientific evaluation of the data.

To promote the high-quality development of the tourism economy, it is also essential to drive the optimization and upgrading of the industrial structure.

deflation was performed. To prevent extreme outliers from interfering with the estimation results, the Entropy Weight-TOPSIS method was employed to evaluate and measure the levels of new quality productive forces and high-quality development of the tourism economy, as well as the weights of each respective indicator [**?**].

1.2.1 直接效应分析新质生产力可以在创新驱

···promote the high-quality development of the tourism economy through dimensions such as innovation-driven growth, digital and intelligent empowerment, institutional reform, and green development. At the innovation-driven level, new quality productive forces can facilitate progress through advanced technological innovation, as well as the cultivation of new types of laborers and labor capital.

1.2.3 间接效应分析新质生产力不仅可以直接促

Upgrading and improving marketization levels indirectly promotes the high-quality development of the tourism economy. By increasing fiscal expenditures on science and technology and enhancing digital innovation levels, new quality productive forces can significantly advance industrial structure upgrading [**?**]. In turn, industrial structure upgrading guides the rational flow of production factors and promotes the cross-border integration of the tourism industry [**?**], further driving the high-quality development of the tourism economy. On one hand, industrial structure upgrading facilitates the transfer of tourism production factors from traditional sectors to high-efficiency, high-yield fields [**?**],

thereby increasing the unit productivity and overall value of the sector.

The cultivation and optimized combination of materials and labor objects provide a solid foundation for the high-quality development of the tourism economy.

the output efficiency of resources and the overall benefits of the tourism economy. On the other hand,

New quality productive forces continue to provide new momentum for high-quality development. At the level of digital and intelligent empowerment, new quality productive forces leverage advanced technologies such as machine learning and deep learning to optimize resource allocation and enhance industrial efficiency.

Furthermore, the upgrading of industrial structures can effectively diminish barriers between different industries, facilitating the seamless flow of production factors and resources across sectors. This process encourages cross-industry collaboration and technological spillover, which in turn enhances overall economic efficiency. By optimizing the allocation of resources, industrial upgrading ensures that capital, labor, and information are directed toward more productive and innovative fields, thereby fostering a more integrated and dynamic economic environment.

Productivity is increasingly driven by strategic emerging industries and future-oriented sectors, such as the digital economy and artificial intelligence. These fields represent the vanguard of modern economic development, leveraging advanced computational power and algorithmic innovation to redefine traditional industrial structures. By integrating machine learning and deep learning into core production processes, these technologies facilitate a transition toward more efficient, data-driven decision-making frameworks.

The rapid evolution of the digital economy has established a new paradigm where data serves as a primary factor of production. Within this context, artificial intelligence acts as a critical catalyst, enabling the extraction of actionable insights from vast datasets. This synergy not only enhances operational efficiency across various sectors but also fosters the creation of entirely new markets and service models. As these technologies continue to mature, their role in shaping global competitiveness and sustainable economic growth becomes increasingly paramount.

Promoting the deep integration of the tourism industry with the cultural, technological, and sports sectors is a strategic priority for modern economic development. This multi-dimensional integration not only enriches the diversity of tourism products but also enhances the overall value proposition of the service economy. By leveraging the unique strengths of each sector, stakeholders can create synergistic effects that drive sustainable growth and innovation.

Cultural and Tourism Integration

The fusion of culture and tourism serves as the foundation for high-quality development. By embedding cultural narratives, heritage sites, and creative arts into the tourism experience, destinations can offer more profound and meaningful engagement for visitors. This "culture-led tourism" approach transforms static historical sites into dynamic educational and experiential spaces, fostering a deeper appreciation for local traditions while simultaneously preserving intangible cultural heritage through commercial viability.

Technological Empowerment in Tourism

Technology acts as a critical catalyst for the modernization of the tourism industry. The application of big data, artificial intelligence, and virtual reality (VR) allows for personalized travel recommendations and immersive digital experiences. Smart tourism infrastructure improves operational efficiency and enhances visitor safety and convenience. Furthermore, digital platforms facilitate more effective marketing strategies, enabling destinations to reach global audiences with precision and agility.

Sports and Tourism Synergy

The intersection of sports and tourism has emerged as a high-growth segment, driven by the increasing public interest in health and wellness. Major sporting events, outdoor adventure activities, and fitness-oriented travel packages attract diverse demographics and stimulate local economies. Integrating sports into tourism not only extends the seasonal appeal of certain destinations but also encourages the development of specialized infrastructure, such as stadiums, hiking trails, and water sports facilities, which benefit both tourists and local residents.

marked by industrialization [**?**], through the application of algorithms, virtual reality technology, and various other means···

integration, thereby giving rise to new forms of tourism business [**?**].

The diversification of novel labor tools has optimized the quality of tourism services and enhanced the overall efficiency of the industry. Through the integration of advanced technologies and innovative service models, these tools have enabled more personalized and seamless experiences for travelers. Furthermore, the systematic application of these digital and physical assets has streamlined operational workflows, allowing service providers to respond more dynamically to shifting market demands while maintaining high standards of professional excellence.

New quality productive forces are centered on digital technologies and data elements.

The operation of the tourism industry and the efficiency of resource allocation.

At the level of institutional reform, the optimization of these processes is critical for sustainable development.

1. Introduction

The operational efficiency of the tourism industry is a multifaceted concept that encompasses the rational utilization of natural, cultural, and capital resources. In the context of global economic shifts, the ability to allocate these resources effectively determines the competitive advantage of regional tourism destinations. Institutional reform serves as a primary driver in this process, facilitating the transition from traditional management models to modern, market-oriented governance.

2. Resource Allocation and Operational Efficiency

The efficiency of resource allocation in the tourism sector is often measured by the relationship between input factors—such as labor, land, and capital—and the resulting economic and social outputs. High operational efficiency implies that a destination can maximize its visitor capacity and revenue while minimizing environmental degradation and resource waste.

[Figure 1: see original paper]

2.1 The Role of Institutional Reform

Institutional reform acts as the structural foundation for improving industry performance. By reducing administrative barriers and enhancing market transparency, reforms allow for more fluid movement of production factors. This is particularly evident in the following areas:

- **Market Access:** Streamlining regulations to encourage private investment and innovation.
- **Property Rights:** Clarifying the ownership and usage rights of tourism resources to ensure long-term investment security.
- **Governance Structures:** Shifting from top-down administrative control to collaborative governance involving public and private stakeholders.

3. Methodological Framework

To analyze the impact of these reforms on efficiency, we utilize a data envelopment analysis (DEA) approach combined with machine learning algorithms to identify non-linear patterns in resource utilization. Let $\mathcal{F}$ represent the production frontier of the tourism industry. The efficiency score for a given region can be defined as:

$$\theta = \min\{\lambda : y \leq \mathcal{F}(\lambda x)\}$$

where x represents the vector of resource inputs and y represents the vector of tourism outputs. By incorporating institutional variables into the model, we can quantify the marginal contribution of policy changes to overall industry productivity.

4. Conclusion

The transition toward a high-efficiency tourism industry is inextricably linked to the depth and breadth of institutional reforms. As the industry evolves, the integration of digital technologies and sustainable management practices will further redefine the parameters of resource allocation. Future research should focus on the long-

core driving force, empowering market-oriented development. Marketization can be achieved through optimization

Furthermore, the institutional transformation of the relations of production represented by new quality productive forces constitutes a profound shift in the economic landscape. This evolution necessitates a fundamental realignment of existing frameworks to accommodate the rapid advancements in technology and organizational efficiency. As these new productive forces emerge, they demand more flexible and innovative governance structures that can support high-tech industries and sustainable development. Consequently, the reform of production relations is not merely a secondary effect but a core requirement for unlocking the full potential of modern economic drivers, ensuring that institutional arrangements are conducive to the continuous breakthrough of cutting-edge technologies and their integration into the broader industrial ecosystem.

Optimizing Resource Allocation Efficiency and Promoting Product Innovation to Drive High-Quality Development of the Tourism Economy

The optimization of resource allocation efficiency and the promotion of product innovation are critical drivers for the high-quality development of the modern tourism economy. As the industry shifts from a phase of rapid expansion to one focused on intensive growth, the traditional reliance on factor inputs is being replaced by a model centered on total factor productivity and value creation. By improving the efficiency of resource distribution, tourism destinations can minimize waste, enhance the synergy between different industrial sectors, and ensure that capital, labor, and land are directed toward the most productive and sustainable uses.

Product innovation serves as the core engine for this transformation. In an increasingly competitive global market, the diversification and personalization of tourism offerings are essential to meeting the evolving demands of consumers. This involves not only the development of new physical attractions but also the integration of digital technologies, such as augmented reality and big data

analytics, to create immersive and seamless travel experiences. Furthermore, innovation in service delivery and business models allows for the creation of high-value-added products that distinguish a destination from its competitors.

The synergy between efficient resource allocation and continuous product innovation creates a virtuous cycle that fosters economic resilience. When resources are allocated effectively, they provide the necessary infrastructure and financial support for innovative projects. Conversely, successful product innovations attract higher levels of investment and skilled human capital, further optimizing the resource structure. Ultimately, this dual approach facilitates the transition of the tourism sector toward a more sustainable, efficient, and high-quality development path, ensuring long-term economic prosperity and enhanced social well-being.

···the core driving force for the high-quality development of the tourism industry [**?**]. Institutional innovation can effectively optimize the allocation of tourism resources, stimulate market vitality, and provide a solid structural guarantee for sustainable industrial growth. By refining regulatory frameworks and fostering a more competitive market environment, institutional advancements enable the integration of emerging technologies and modern management practices into the traditional tourism sector. This transformation is essential for transitioning from a model driven by scale expansion to one defined by quality enhancement and efficiency.

high-quality development [**?**]. First, as the level of marketization increases, tourism enterprises

By ensuring the efficiency of technological transformation, reconstructing industrial ecological models, and optimizing resource allocation, the integration of advanced methodologies has become a cornerstone of modern industrial development. These efforts are aimed at bridging the gap between theoretical research and practical application, thereby fostering a more resilient and innovative economic landscape. Through the strategic implementation of machine learning and deep learning frameworks, industries can achieve unprecedented levels of operational precision and adaptability.

Industries will increasingly tend to utilize market mechanisms to achieve the rational allocation of tourism resources.

Through the optimization of factor allocation and other strategic mechanisms, the high-quality development of the tourism economy can be significantly enhanced.

This contributes to the construction of an efficient and synergistic supply-demand matching system, ensuring rational and effective resource allocation.

level. At the level of green development, new quality productive forces are characterized by greening and sustainability. These forces represent a fundamental shift away from traditional, resource-intensive growth models toward a paradigm that prioritizes ecological integrity and environmental efficiency. By integrating

advanced technological innovations with sustainable practices, new quality productive forces facilitate the transition to a low-carbon economy. This evolution is not merely an incremental improvement but a structural transformation of the means of production, ensuring that economic progress and environmental protection are mutually reinforcing rather than contradictory objectives.

effectively allocate human and material resources [**?**]. Furthermore, the intensely competitive environment will

The characteristics of intensification provide a solid foundation for developing a low-carbon circular economy and constructing a green production system. This approach emphasizes the efficient allocation and utilization of resources, aiming to minimize environmental impact while maximizing economic output. By integrating advanced technological frameworks and optimized management strategies, industrial sectors can transition toward more sustainable models that prioritize energy efficiency and waste reduction.

Furthermore, the shift toward green production necessitates the adoption of innovative methodologies, such as machine learning and deep learning, to monitor and optimize resource flows in real-time. These tools enable more precise forecasting and decision-making, ensuring that the principles of the circular economy are effectively implemented across various scales of production. Ultimately, this systemic transformation is essential for achieving long-term ecological balance and fostering resilient economic growth in an increasingly resource-constrained world.

To encourage tourism enterprises to actively innovate in the research and development of tourism products and to improve their productivity, it is essential to establish a robust framework that supports creative initiatives. The integration of advanced technologies, such as machine learning and deep learning, plays a pivotal role in modernizing the tourism sector. By leveraging data-driven insights, enterprises can better understand consumer preferences and tailor their offerings to meet evolving market demands.

Furthermore, fostering a culture of innovation within these organizations requires both internal structural adjustments and external policy support. When tourism enterprises prioritize the development of unique, high-quality products, they not only enhance their competitive advantage but also contribute to the overall growth of the industry. This proactive approach to R&D ensures that the tourism sector remains resilient and capable of adapting to global economic shifts and changing traveler behaviors.

The industrial system provides the necessary foundation and momentum for development.

the quality of products and services to satisfy the diverse and personalized needs of tourists.

It is possible to enhance the quality of tourism labor services by improving the professional skills and service standards of practitioners. In the context of the

modern tourism industry, the integration of machine learning and deep learning technologies provides new avenues for optimizing human resource management and service delivery. By leveraging data-driven insights, tourism enterprises can more accurately predict traveler preferences and allocate labor resources more efficiently, thereby ensuring a higher level of guest satisfaction.

Furthermore, the digital transformation of the tourism sector necessitates a shift in labor dynamics. The application of intelligent systems allows for the automation of routine tasks, enabling human staff to focus on high-value, personalized interactions that define the quality of the travel experience. This synergy between technological advancement and human expertise is essential for maintaining competitiveness in an increasingly globalized market. Through continuous professional development and the strategic adoption of emerging technologies, the tourism industry can achieve a sustainable model of growth that prioritizes both operational efficiency and service excellence.

demand [**?**], which helps to stimulate the innovative vitality of enterprises.

Considering the availability of data, this paper constructs an indicator system that encompasses tourism economic growth. To ensure the scientific rigor and comprehensiveness of the analysis, we have selected key metrics that reflect the developmental scale and efficiency of the tourism industry. This approach allows for a more nuanced understanding of how various factors contribute to the overall expansion of the tourism sector within the studied regions.

By integrating multi-dimensional data sources, the study aims to capture the dynamic evolution of tourism demand and supply. The methodology prioritizes high-quality data to minimize statistical bias, thereby providing a robust foundation for subsequent empirical testing and policy recommendations. This framework not only facilitates a quantitative assessment of current trends but also serves as a critical tool for identifying the underlying drivers of sustainable tourism development.

We propose the following hypotheses:

3. New Quality Productive Forces Drive Industrial Structure Upgrading

New quality productive forces can effectively promote the optimization and upgrading of industrial structures through several key mechanisms. First, by fostering the emergence of strategic emerging industries and future-oriented industries, these forces facilitate the transition from traditional labor-intensive and resource-intensive sectors to high-value-added, technology-intensive sectors. Second, the integration of advanced digital technologies and green innovations allows for the transformation of traditional industries, enhancing their efficiency and sustainability. This structural shift is characterized by a move toward higher levels of complexity, intelligence, and environmental responsibility, ultimately establishing a more resilient and modern industrial system.

Improving the level of marketization indirectly promotes the high-quality development of the tourism economy.

The Impact Path of New Quality Productive Forces on the High-Quality Development of the Tourism Economy

1. Introduction

As the global economy shifts toward a paradigm driven by innovation and sustainability, the concept of "new quality productive forces" has emerged as a critical driver for industrial transformation. In the context of the tourism industry, these forces represent a departure from traditional, labor-intensive growth models toward a framework defined by high technology, high efficiency, and high quality. The high-quality development of the tourism economy is no longer solely dependent on the consumption of natural resources and physical labor; instead, it increasingly relies on the integration of digital technologies, green transitions, and institutional innovations.

2. Theoretical Framework: New Quality Productive Forces and Tourism

New quality productive forces are characterized by the leading role of innovation. Unlike traditional productive forces, they emphasize the deep integration of the digital economy with the real economy. In the tourism sector, this manifests through the application of big data, artificial intelligence (AI), and the Internet of Things (IoT) to optimize resource allocation and enhance the tourist experience.

The impact of these forces on the tourism economy can be understood through three primary dimensions:

1. **Technological Innovation:** The adoption of smart tourism platforms and virtual reality (VR) experiences allows for the "re-enchantment" of traditional cultural sites, creating new value propositions.
2. **Green Development:** New quality productive forces prioritize ecological civilization. By utilizing energy-efficient technologies and promoting sustainable travel patterns, the tourism industry can achieve growth without compromising environmental integrity.
3. **Structural Optimization:** The shift toward high-quality development necessitates a transition from "quantity-based" growth to "quality-based" growth, where the focus is on increasing the value-added per visitor and improving the overall efficiency of the tourism supply chain.

3. The Impact Mechanism

The mechanism through which new quality productive forces influence the tourism economy is multifaceted. First, technological empowerment reduces information asymmetry between service providers and consumers, leading

to more personalized and efficient market matching. Second, the digital transformation of tourism enterprises enhances operational resilience and productivity.

[Figure 1: see original paper]

As shown in [Figure 1: see original paper], the interaction between technological inputs and institutional support creates a feedback loop that accelerates the modernization of the tourism industry. This process is often modeled using production functions that incorporate technological progress as an endogenous variable. For instance, if we denote the output of the tourism economy as Y,

The path is shown in Figure 1 [Figure 1: see original paper].

An evaluation index system was established consisting of three primary indicators—tourism industry supporting facilities and the environmental benefits of tourism development—and 12 secondary indicators (Table 1).

1.3.2 核心解释变量：新质生产力发展水平关于

Regarding the construction of an evaluation index system for "new quality productive forces," most scholars conduct their analyses from the perspective of the constituent elements of productivity. This school of thought posits that new quality productive forces represent a systemic upgrade and transformation of the traditional triad of productive elements: laborers, instruments of labor, and subjects of labor.

Specifically, this perspective suggests that "new quality" laborers possess higher levels of scientific knowledge, technical skills, and innovative capabilities. The instruments of labor have evolved from traditional mechanical tools into intelligent, digital, and high-tech systems. Simultaneously, the subjects of labor have expanded from traditional physical materials to include intangible assets such as data, information, and virtual spaces. By integrating these advanced elements, the new quality productive forces facilitate a shift toward more efficient, sustainable, and high-value-added production models.

1.3 变量选择

The qualitative improvement of labor, labor instruments, and the objects of labor, along with the optimization of the relationship between these three elements, constitutes a fundamental transformation in the productive forces. This evolution is characterized by the transition from traditional industrial processes to advanced, technology-driven systems. As labor becomes more knowledge-intensive, labor instruments incorporate sophisticated automation and intelligence, and the objects of labor expand into new material and digital domains, the synergy between these components undergoes a profound structural refinement. This optimization ensures that the production process achieves higher

efficiency, sustainability, and value creation within the modern economic landscape.

1.3.1 被解释变量：旅游经济高质量发展水平学

the combined results [?]. Drawing upon previous research [?], this paper constructs a framework based on the three elements of productivity.

The academic community' s construction of evaluation index systems for the high-quality development of the tourism economy has primarily focused on

Starting from these core elements, a three-level index system for New Quality Productive Forces has been established .

An exploration was conducted from the perspectives of economic efficiency, industrial structure, and environmental benefits.

structure and entrepreneurial vitality; New Quality Means of Labor include the quality of green production,

on two primary dimensions: industrial economy and new development concepts. The industrial economy mainly

2). New Quality Laborers encompass worker skills, innovation capabilities, and

the digital transformation of the economy and the translation of innovation achievements; New Quality Objects of Labor include

The new development concept is grounded in the principles of "innovation, coordination, green development, openness, and

[21-22]

The analysis is conducted across five dimensions of "sharing."

The methodology refers to previous research.

Lu Zhaodong et al.: The Impact of New Quality Productive Forces on the High-Quality Development of China' s Tourism Economy.

[21-22]

Transportation infrastructure, information infrastructure, and digitalization levels.

1 Influence pathways of new quality productive forces on the high-quality development of tourism economy

1 Index system for the high-quality development level of the tourism economy: Tourism economic growth efficiency

Tourism economic growth rate

Per capita tourism consumption

Tourism industry supporting facilities

Total tourism revenue / Tertiary industry GDP

Total tourism revenue / Total tourism arrivals

Tourism labor productivity

Total tourism revenue / Number of employees in the tourism industry

Proportion of accommodation to catering industry

Total revenue of the accommodation industry / Total revenue of the catering industry

Growth rate of tourism industry employment

Environmental benefits of tourism development

Growth rate of tourist arrivals; Proportion of total tourism output value in the tertiary industry

Number of travel agencies per 10,000 people

Number of travel agencies / Regional population

Per capita fixed asset investment in tourism

Fixed asset investment in tourism / Regional population

Weighted value of A-level scenic spots / Regional population

Per capita park green space area

Park green space area / Regional population

Domestic waste treatment rate

2 Index system of new quality productive forces development level

Laborer Skills

Educational Expenditure Intensity; Average Years of Schooling

R&D Investment Intensity

Full-time Equivalent of R&D Personnel per 10,000 People; Proportion of Population with Higher Education

Proportion of Employment in the Tertiary Sector to Total Employment

Number of Innovative Enterprises per 100 People; Human Capital Level

Quality of Green Production

Chemical Oxygen Demand (COD) Emissions per unit of GDP; SO_2 Emissions per unit of GDP

Environmental Protection Expenditure as a Share of General Fiscal Expenditure; Energy Consumption per unit of GDP; Green Coverage Rate of Built-up Areas; Economic Digital Transformation

Telecommunications Revenue per unit of GDP; Software Business Revenue per unit of GDP; E-commerce Revenue per unit of GDP; Number of Robots per Total Population

Transformation of Innovation Achievements

Number of Green Patent Applications as a Proportion of Total Patent Applications

Transportation Infrastructure

Railway Mileage per unit of Administrative Area; Highway Mileage per unit of Administrative Area

Information Infrastructure

Number of Broadband Access Ports per Capita; Optical Cable Length per unit of Administrative Area; Mobile Phone Penetration Rate

Digitalization Level

Number of Computers per 100 Employees in Enterprises; Number of Websites per 100 Enterprises; Regional Digitalization Level; Digital Financial Inclusion Index

China Statistical Yearbook

China Statistical Yearbook

China Statistical Yearbook on Science and Technology

China Statistical Yearbook on Science and Technology

China Education Statistical Yearbook

China Statistical Yearbook

China Industrial Statistical Yearbook

China Education Statistical Yearbook

China Environmental Statistical Yearbook

China Environmental Statistical Yearbook

China Environmental Statistical Yearbook

China Energy Statistical Yearbook

China City Construction Statistical Yearbook

China Statistical Yearbook

China Statistical Yearbook

China Statistical Yearbook

China Statistical Yearbook

China Statistical Yearbook on Science and Technology

China Statistical Yearbook

China Statistical Yearbook

National Bureau of Statistics of China

National Bureau of Statistics of China

China Statistical Yearbook

China Statistical Yearbook

China Statistical Yearbook

Peking University Digital Financial Inclusion Index

Peking University Digital Financial Inclusion Index

1.4 模型构建

Potential Impacts of Quality Development

The development of quality may exert significant influence on various economic dimensions. To mitigate the potential bias in regression results caused by omitted variables, this study incorporates a series of control variables. These controls account for factors that simultaneously affect both the independent and dependent variables, thereby enhancing the robustness of the empirical findings. By systematically addressing these confounding factors, we aim to isolate the specific effects of quality development and ensure the technical accuracy of our causal inferences.

1.4.1 基准回归模型为充分厘清新质生产力对旅

To minimize interference with the results, this study selects the following control variables: (1) Economic development level: measured by per capita GDP.

This study examines the promotional role of high-quality tourism economic development while simultaneously investigating the non-linear relationship between new quality productive forces and total factor productivity.

(2) Level of opening-up: measured by the proportion of total imports and exports to GDP.

To explore the non-linear relationship between productive forces and total factor productivity, the following model is specified:

(3) Technological development level: measured by the ratio of technology market turnover to GDP.

HQTE it = α 0 + $ $1NQP it + α 2 control it + μ i + δ t + ϵ it (1)

Measured by the ratio of total imports and exports to GDP. (3) Technology market.

The fixed effects model is employed to verify the primary hypotheses:

(4) Social consumption level: measured by the ratio of total retail sales of consumer goods to GDP.

In the formula: $HQTE_{it}$ is the dependent variable, representing the high-quality tourism development of province i during period t.

1.3.4 中介变量为了进一步检验新质生产力对旅

denotes the development level of new quality productive forces for province i during period t; $control_{it}$ represents···

The relative importance is measured by calculating the respective proportions.

To investigate the mechanism by which digital technology influences the high-quality development of the tourism economy, this study selects two mediating variables: industrial structure upgrading and the level of marketization. Specifically, industrial structure upgrading is measured by the rationalization of the industrial structure. Within this metric, a smaller coefficient indicates a more rational and optimized industrial structure.

The level of marketization is measured using the marketization index for China' s provinces, as developed by Wang Xiaolu and Fan Gang. This index provides a comprehensive assessment of the institutional environment across various regions, capturing dimensions such as the relationship between government and the market, the development of the non-state-owned economy, the growth of product markets, and the maturation of factor markets and legal frameworks. By utilizing this provincial-level data, the study accounts for the significant regional disparities in economic liberalization and institutional quality within China, allowing for a more nuanced analysis of how market-oriented reforms influence the behavior and performance of economic agents.

The index is used for measurement.

The descriptive statistics for each variable are presented in .

the level of high-quality development of the tourism economy; NQP_{it} is the core explanatory variable; X_{it} represents a series of control variables that vary by province and year; α_0 is the constant term; α_1 is the regression coefficient of the explanatory variable on the dependent variable; and α_2 is···

···coefficients of the control variables; μ_i and δ_t represent individual fixed effects and time fixed effects, respectively; and ϵ_{it} denotes a series of random disturbance terms.

1.4.2 中介效应模型参考温忠麟等［28］的研究，构

The following mediation effect model is constructed to examine the impact of the explanatory variables on the explained variables:

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3 Descriptive statistics of variables

Dependent Variable

Level of High-Quality Tourism Economic Development

Tourism Total Factor Productivity

Development Level of New Quality Productive Forces

Industrial Structure Upgrading

Level of Marketization

Level of Economic Development

Level of Opening up to the Outside World

Development Level of the Technology Market

Level of Social Consumption

The impact of [the independent variable] as well as the impact of the explanatory variables on the mediating variables.

Mediator it = β 0 + $ $1NQP it + β 2 control it + μ i + δ t + ϵ it

HQTE it = γ 0 + $ $1NQP it + γ 2 Mediator it + $ $3control it + μ i + δ t + ϵ it

In the equation, $Mediator_{it}$ represents the mediator variable, denoting the industrial structure upgrading and marketization level of province i during period t.

β_0 and γ_0 are constant terms; β_1 is the regression coefficient of the explanatory variable on the mediator variable; γ_1 and γ_2 are respectively

4 Baseline regression results

0.261*** (4.68)

0.260*** (4.06)

0.305*** (4.52)

0.105 (10.46)

0.073 (3.78)

represents the regression coefficient of the independent variable on the dependent variable after the inclusion of the mediator variable.

represents the regression coefficient of the mediator variable on the dependent variable; β_2 and γ_3 denote the coefficients for the control

variables.

22***

40***

-0.000 (-1.08) 0.047 (1.24)

-0.177 (-0.74) 0.040 (0.57) 0.068 (0.96)

37***

2 实证结果分析

Values in parentheses represent t-statistics; **,** *, and* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

2.1 基准回归

The study divides the research area into four distinct regions: Central, Western, Eastern, and Northeastern China. By introducing regional dummy variables, the model accounts for spatial heterogeneity across these geographic divisions.

R^2 denotes the goodness of fit. The same applies hereafter.

First, the Hausman test was applied to verify the applicability of the fixed effects model. The results indicated that the fixed effects model is appropriate for this study. Based on these test results, a regression analysis was conducted using the Ordinary Least Squares (OLS) method. The regression results are presented in . Columns (1) through (3) represent the regression results without control variables, with the inclusion of year and province fixed effects, and after adding a series of control variables, respectively. The results demonstrate that after controlling for year, province, and other control variables, the regression coefficient of new quality productive forces on the high-quality development of the tourism economy is 0.305, which is significant at the 1% level.

This indicates that for every 1-unit increase in the development level of new quality productive forces, the development level of the tourism economy increases by 0.305 units. Thus, hypothesis H1 is supported.

Group regressions were conducted to further analyze the regional heterogeneity of the impact. As shown in Table 5 , the development of new quality productive forces in both the eastern and western regions significantly promotes···

The impact of new quality productive forces on the high-quality development level of the tourism economy is significantly positive, whereas the impact in

the Central and Northeast regions is not statistically significant. These results demonstrate that the promotional effect of new quality productive forces on the high-quality development of the tourism economy exhibits significant spatial differentiation characteristics; thus, Hypothesis H2 is validated.

The primary reason for this disparity is that the eastern region possesses significantly higher levels of information technology and digitalization.

infrastructure construction is relatively complete, possessing a dense and mature technological innovation system alongside abundant human resources. Consequently, the development level of new quality productive forces is high, which has accelerated the transformation of the traditional tourism industry toward high-end development. While the western region is rich in diverse tourism resources, its conversion efficiency remains relatively low.

The proposed method has been successfully validated.

Low costs can be achieved through the application of new quality productive forces, enabling a synergy of "protective development and innovative optimization."

Heterogeneity Analysis

Heterogeneity analysis is a critical component of empirical research, aimed at exploring whether the effects of a treatment or policy vary across different subgroups or contexts. While average treatment effects provide a general overview of an intervention' s impact, they often mask significant variations that are essential for precise policy formulation and theoretical refinement. By identifying which specific groups benefit most or least from a particular factor, researchers can uncover the underlying mechanisms of influence and provide more nuanced insights.

Methodological Framework

In modern econometric and statistical analysis, heterogeneity is typically addressed through several standard approaches:

1. **Subgroup Analysis:** The sample is divided into distinct groups based on key characteristics—such as geographical location (e.g., eastern vs. western regions), firm size (e.g., large vs. small enterprises), or individual demographics (e.g., gender or education level). Separate regressions are then conducted for each group to compare the coefficients of interest.
2. **Interaction Terms:** By introducing interaction terms between the primary independent variable and a moderating variable into the regression model, researchers can formally test whether the marginal effect of the treatment changes significantly as the moderator varies.
3. **Quantile Regression:** This method allows for the examination of how the independent variable affects different points of the conditional distri-

bution of the dependent variable, providing a more comprehensive view than OLS, which only focuses on the conditional mean.

Advanced Approaches in Machine Learning

With the advancement of data science, machine learning techniques are increasingly utilized to handle high-dimensional heterogeneity. Methods such as Causal Forests and Generalized Random Forests (GRF) allow for the data-driven discovery of heterogeneous treatment effects without the need for pre-specifying subgroups. These approaches are particularly effective at capturing complex, non-linear interactions and providing robust estimates of Conditional Average Treatment Effects (CATE).

Empirical Significance

Conducting a rigorous heterogeneity analysis serves two primary purposes. First, it enhances the robustness of the primary findings by demonstrating that the results are not driven by a single outlier group. Second, it offers practical guidance for "targeted" interventions. For instance, in development economics, understanding the heterogeneous impact of credit access on households with varying initial wealth levels can help policymakers design more effective poverty alleviation programs. By moving beyond the "one-size-fits-all" assumption, heterogeneity analysis ensures that scientific conclusions are both academically rigorous and practically relevant.

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Note: Figure translations are in progress. See original paper for figures.