

RESEARCH ON THE COORDINATED PATHWAYS OF ENVIRONMENTAL SUSTAINABILITY AND ECONOMIC EFFICIENCY IN GREEN ECONOMY TRANSFORMATION: A LITERATURE-BASED ANALYSIS OF THE TOURISM INDUSTRY

Hao Xiaohui

"Silk Road" International University of Tourism and Cultural Heritage., Samarqand, Uzbekistan

E-mail: 409576331@qq.com

DOI: 10.61587/mmit.tiue.uz.v1i1.365

Abstract. Against the backdrop of climate change, resource constraints, and the continued advancement of low-carbon transition, the green economy has gradually evolved from a governance issue centered on environmental protection into an integrated development model that incorporates technological innovation, institutional coordination, industrial upgrading, and sustainable consumption. Based on recent literature on the green economy, green technological innovation, the digital economy, green finance, and sustainable tourism development, this paper adopts literature analysis and thematic induction to examine the coordinated pathways through which environmental sustainability and economic efficiency can be integrated in the tourism industry. The study argues that the green economy does not imply a weakening of economic vitality; rather, it improves the quality of growth through green technologies, policy coordination, resource-conservation mechanisms, and behavioral guidance. In the tourism industry, green transformation should not remain merely at the level of ecological protection, but should be embedded throughout the entire process of destination management, infrastructure construction, digital governance, community participation, and the cultivation of tourists' pro-environmental behavior.

Keywords: *green economy; tourism industry; environmental sustainability; economic efficiency; green technology.*

Introduction

The core of the green economy is to redefine the relationship between economic growth and the ecological environment. Traditional growth models often rely on high resource input and the externalization of environmental costs. Although such models can expand the economic scale in the short term, they are likely to result in ecological degradation, resource waste, and a decline in long-term competitiveness. In recent years, green transformation has increasingly been understood as a systemic socioeconomic change. Its focus is no longer limited to pollution control; instead, it seeks to jointly promote a transformation in development patterns through institutions, technologies, and market mechanisms. Relevant studies indicate that comprehensive green transformation requires a balance between development and emission reduction, between government and market, and between overall advancement and targeted breakthroughs, which also provides a new perspective for understanding the institutional foundation of the green economy[1].

There is an inherent connection between tourism and the green economy. Natural landscapes, cultural heritage, and the ecological environment are not only sources of destination attractiveness but also important foundations for the sustainable development of the tourism industry. If excessive tourism development relies on the expansion of visitor flows and resource consumption, destinations may obtain short-term economic gains while damaging ecological carrying capacity and long-term brand value. Therefore, green transformation in tourism is not only a requirement of environmental protection but also an important means of improving service quality, resource allocation efficiency, and destination competitiveness. Sustainable tourism research suggests that tourism development should transform ecological protection into the long-term capacity of regional economic development through local governance, market guidance, and public participation[7].

Literature Review and Methods

Existing studies explain the formation mechanisms of the green economy mainly from the perspectives of technological innovation, institutional governance, digital empowerment, green finance, and tourist behavior. Green technological innovation is an important foundation for integrating environmental sustainability and economic efficiency. Studies on national pilot zones for agricultural green development show that policy pilots can promote green technological innovation through environmental regulation, public attention, capital agglomeration, and talent mobility. This indicates that the policy environment can influence the diffusion of green technologies and improve industrial efficiency[2]. Regional studies also show that technology transfer can improve green economic efficiency by optimizing the allocation of innovation resources and strengthening the connections within scientific research networks; the role of green technology transfer is particularly evident[3].

The operation of the green economy also depends on institutional constraints and policy continuity. Reliance solely on corporate voluntarism or consumer awareness is insufficient to fully resolve environmental externalities. Instruments such as green finance, policy auditing, ecological compensation, and environmental regulation can incorporate ecological costs into economic decision-making and reduce short-term development tendencies. Research on the coordination between financial technology and green finance shows that the integration of technological and financial instruments helps enhance economic resilience, but its effect is influenced by the regional institutional environment and the level of technological adaptation[4]. This conclusion suggests that the green economy is not a transformation process that can be completed by a single policy instrument; instead, it requires stable coordination among technology, finance, and institutions.

Digital technologies provide a new efficiency foundation for the green economy. Big data, cloud computing, and artificial intelligence can strengthen resource allocation, environmental monitoring, and public service capacity, shifting green governance toward a refined management model. Research on the integration of the intelligent economy and the green economy indicates that intelligent technologies can jointly promote green development by improving energy efficiency, optimizing industrial structure, and enhancing environmental governance[5]. In tourism contexts, digital platforms can be used for tourist reservations, scenic-area capacity regulation, low-carbon route recommendations, energy-consumption monitoring, and service-process optimization, thereby reducing ecological pressure while improving the tourist experience.

This paper adopts literature analysis and thematic induction. The research materials are mainly drawn from recent literature on the green economy, green technological innovation, the digital economy, green finance, and green tourism development, supplemented by international studies on sustainable tourism and green growth as theoretical references. The analysis centers on the integration of environmental sustainability and economic efficiency, with particular attention to how the green economy influences the transformation of the tourism industry through technological, institutional, market-based, and behavioral mechanisms. Because this paper is literature-based, its conclusions mainly reflect theoretical synthesis and pathway analysis and have not yet been empirically tested.

Results and Discussion

The literature synthesis indicates that the green economy is not a simple constraint on economic growth but an adjustment of growth quality and patterns. Green technological innovation reduces resource consumption and environmental damage per unit of output, enhancing the compatibility between ecological protection and economic efficiency. Using data from E7 countries, Sun et al. confirmed a positive relationship among green innovation, resource efficiency, and sustainable economic growth, demonstrating that green technology

carries both environmental and economic significance[8]. For tourism, green transformation is particularly challenging because its economic returns are closely tied to visitor flows, spatial development, and consumption activities. Without carrying-capacity assessment and ecological constraints, tourism expansion may increase environmental pressure. Research on Tibet's tourism economy shows that, under the dual-carbon goals, the industry must dynamically coordinate economic output, resource utilization, and undesirable environmental outputs[6]. Tourist behavior is a critical yet often overlooked dimension. Green infrastructure and institutional arrangements improve supply-side conditions, but whether tourists participate in green consumption and comply with ecological norms directly affects governance effectiveness. Studies on national park visitors reveal that nature connectedness and emotional states influence pro-environmental behavior, suggesting that destination atmosphere and environmental education play important roles[6]. International studies further show that green tourism coordinates economic growth and ecological protection through governance innovation, with local governments, marketing tools, and smart city development playing key roles[7], while community participation and stakeholder collaboration are also essential[9].

The development trend of the green economy is shifting from single-dimensional environmental governance toward comprehensive economic-social transformation. For tourism, green transformation can follow four relatively stable pathways: the technological pathway (green buildings, clean energy, smart scenic areas, low-carbon transportation), the institutional pathway (ecological red lines, carrying capacity assessment, green certification, ecological compensation), the market pathway (green finance, ecological product value realization, green branding), and the behavioral pathway (tourist environmental education, community participation, pro-environmental consumption). These pathways are interdependent. Technology improves efficiency but requires institutional constraints to change high-consumption models; institutions set boundaries but need market incentives to motivate enterprises; even with expanded green product supply, lack of tourist environmental awareness prevents stable demand. Therefore, the green economy in tourism is best advanced through a collaborative governance approach, forming a closed loop among technology, institutions, markets, and social participation.

Table 1

Synergistic Mechanisms of Environmental Sustainability and Economic Efficiency in the Green Economy Transformation of Tourism

Analytical Dimension	Mechanism of Action	Contribution to Environmental Sustainability	Contribution to Economic Efficiency
Green technological innovation	Diffusion of green technologies, technology transfer, energy-saving equipment, and application of low-carbon infrastructure	Reduces energy consumption and environmental damage, thereby mitigating the pressure of tourism development on ecosystems	Reduces operating costs and improves resource-use efficiency and destination-management capacity
Institutional collaborative governance	Environmental regulation, ecological compensation, green certification, and carrying-capacity management	Constrains excessive development and safeguards ecological security and resource boundaries	Reduces the long-term governance costs of extensive development and enhances the stability of tourism development
Digital management	Big data, artificial intelligence, tourist reservation systems, capacity regulation, and energy monitoring	Improves environmental monitoring capacity and reduces scenic-area congestion, resource waste, and management blind spots	Improves operational precision, service efficiency, and the quality of tourist experience
Green finance and market transformation	Green finance, transformation of ecological product value, green branding, and the supply of low-carbon products	Provides sustained investment for environmental facilities, low-carbon projects, and ecological restoration	Expands the supply of green tourism products and enhances destination brand value and market competitiveness
Community participation and tourist behavior	Environmental education, cultural narratives, community collaboration, and guidance of tourists' pro-environmental behavior	Promotes the joint participation of tourism stakeholders in ecological protection and reduces irrational consumption in tourism activities	Enhances tourist satisfaction, local identity, and the long-term attractiveness of destinations

Conclusion

The formation and development of the green economy is essentially a process in which environmental sustainability and economic efficiency are continuously coordinated. The relevant literature shows that the green economy is no longer limited to pollution control and ecological protection; rather, it has gradually developed into a comprehensive economic form that includes green technology, green finance, digital empowerment, institutional coordination, and consumption transformation. For the tourism industry, the green economy both imposes ecological constraints and creates development opportunities. Ecological constraints require tourism development to respect resource boundaries and environmental carrying capacity, while development opportunities are reflected in enhancing destination brands, improving service quality, strengthening industrial resilience, and transforming the value of ecological resources.

Future development of the tourism green economy should place greater emphasis on systematic governance. Destinations need to apply green technologies to scenic-area management, transportation, accommodation, and energy systems; use digital technologies for tourist capacity regulation and resource-allocation optimization; employ green finance and ecological compensation mechanisms to support long-term investment; and cultivate tourists' pro-environmental behavior through environmental education and community participation. Only by incorporating ecological protection, economic efficiency, and social well-being into a unified framework can the tourism industry achieve long-term competitiveness and sustainable returns within green economic development.

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