Proceedings of the 3rd International Conference on Management Research and Economic Development
DOI: 10.54254/2754-1169/181/2025.22795

Integration of Tourism and the Low-Altitude Economy: Theoretical Foundations, Implementation Pathways, and Sustainable Development

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Abstract: Based on theories of industrial integration and related frameworks, this paper explores the integration of tourism and the low-altitude economy through literature review and case study methods. The two sectors share a solid foundation for integration, with significant potential for synergy in product development, market expansion, and industrial organization. Integration is driven by enterprise collaboration, academia-industry partnerships, and multi-stakeholder coordination. Adhering to the principles of sustainable development is of great significance for promoting industry integration and long-term development. Future efforts should focus on applying new technologies, expanding into international markets, tracking policy developments, and engaging in interdisciplinary research, thus providing stronger support for the growth of this emerging industry.

Keywords: Industrial Integration Theory, Collaborative Innovation Theory, Sustainable Development Theory, Tourism Industry, Low-Altitude Economy

1. Introduction

1.1. Research background and significance

Tourism is a key sector of the global service economy, playing a vital role in driving economic growth and creating employment opportunities. With its rich industrial forms and wide-ranging interconnections, tourism effectively promotes the coordinated development of sectors such as transportation and catering. It serves as a major economic engine and job creator in many regions. The low-altitude economy, an emerging industry centered on general aviation, holds great development potential. It can stimulate the growth of high-end manufacturing and modern service industries while contributing to economic restructuring. In recent years, rising living standards and increasingly diversified tourism demands have led to a stronger pursuit of unique and immersive experiences. On December 27, 2024, the National Development and Reform Commission of China established the Department for the Development of the Low-Altitude Economy. This department is tasked with formulating and implementing development strategies and medium-to-long-term plans for the low-altitude economy, proposing relevant policy recommendations, and coordinating major issues, thereby offering stronger policy support and coordination mechanisms for the sector's development [1]. Against this backdrop, the integration of tourism and the low-altitude economy has

DOI: 10.54254/2754-1169/181/2025.22795

gained strong momentum, and low-altitude tourism projects show broad prospects. Theoretically, this study offers an in-depth analysis of the integration between the two industries, enriching and expanding the theory of industrial integration by providing new perspectives and content. Practically, it contributes to industrial upgrading and transformation, guides resource allocation, and fosters new drivers of regional economic growth, thus bearing both theoretical and practical significance.

1.2. Research methods and objectives

This study adopts a combination of literature review and case analysis methods. By systematically reviewing domestic and international literature, it examines the current state and emerging trends in the integration of tourism and the low-altitude economy. Through an in-depth analysis of representative integration cases, the study uses practical insights to support theoretical exploration. Drawing on theories of industrial integration, collaborative innovation, and sustainable development, it investigates the underlying mechanisms of integration, explores implementation pathways, and clarifies guiding principles to provide scientifically sound and effective guidance for industrial practice.

2. Overview of related theories

2.1. Industrial integration theory

2.1.1. Concept of industrial integration

Industrial integration is not simply the accumulation of industries but rather a dynamic, evolving process. Some scholars, after studying the basic theories of Western industrial integration, pointed out that industrial integration occurs due to technological advancements and regulatory relaxation, which lead to technological convergence at the boundaries and intersections of industries. This results in changes in the competitive and cooperative relationships between enterprises within industries, leading to blurred or even redefined industrial boundaries [2]. Other scholars, based on a comprehensive integration perspective that includes resources, data, labor, and technology, have calculated the potential for integrated development [3]. It is believed that the theory of industrial integration systematically describes the evolutionary process of the integration of cultural and tourism industries, providing a foundation for evaluating the development of cultural-tourism integration from a holistic perspective [4].

2.1.2. Driving forces of industrial integration

Technological innovation is the intrinsic driving force of industrial integration, as it diffuses and integrates into other industries, thus providing momentum for integration [5]. At the same time, changes in market demand prompt enterprises to seek cross-border cooperation to meet consumers' demands for diversified and personalized products and services. Regulatory relaxation eliminates institutional barriers to industrial integration, reduces entry barriers for industries, and stimulates the innovation and cooperation enthusiasm of enterprises.

2.2. Collaborative innovation theory

2.2.1. Concept of collaborative innovation

Collaborative innovation is a value creation process centered on knowledge enhancement, with enterprises, universities, research institutions, governments, and educational departments as the primary innovation entities. It is the integration of various innovation elements and the seamless flow

DOI: 10.54254/2754-1169/181/2025.22795

of innovation resources within the system [6]. These entities engage in deep exchanges and integration of key resources such as talent, technology, and funding, breaking down barriers, jointly investing in innovation, improving efficiency and quality, and driving the output of innovative results.

2.2.2. Models and mechanisms of collaborative innovation

There are various effective models and mechanisms for collaborative innovation. The industry-academia-research cooperation model emphasizes deep collaboration between universities, research institutions, and enterprises. Universities and research institutions, with their advantages in knowledge creation and technological research and development, provide knowledge and technological support for innovation. Enterprises, on the other hand, leverage their market sensitivity and commercialization capabilities to transform research results into practical products or services, thereby realizing commercial value [7]. Another important model is the strategic alliance model, where enterprises establish close cooperative relationships by signing legally binding agreements. They jointly carry out research and development and jointly explore markets to achieve resource sharing and risk sharing [8]. The effective combination of knowledge sharing and benefit distribution mechanisms can promote the stability and sustainability of collaborative innovation. For example, the industry-academia-research collaborative innovation center demonstrates the contribution of knowledge innovation from all three parties through benefit distribution, ensuring fairness and enthusiasm in the innovation process [9].

2.3. Sustainable development theory

2.3.1. Principles of sustainable development

In the context of industrial development, sustainable development follows three main principles: Equity Principle: This principle encompasses intra-generational and inter-generational equity, aiming to ensure that different regions, groups, and future generations equally enjoy resources and development opportunities, thus avoiding imbalances in resource allocation and unequal development opportunities. Sustainability Principle: This principle emphasizes that industrial activities should be constrained by the resource and environmental carrying capacity, enabling long-term stable development and preventing over-exploitation that leads to resource depletion and environmental degradation. Commonality Principle: This principle highlights the need for all entities, both globally and regionally, to share responsibility in the process of industrial development, working together to address environmental and developmental challenges and creating a collective force to achieve sustainable development goals [10].

2.3.2. Application of sustainable development in the industrial sector

In the industrial sector, sustainable development requires balancing economic, social, and environmental benefits. Economic Aspect: Industries should focus on improving resource utilization efficiency, reducing production costs, and enhancing competitiveness. Social Aspect: Industries should create job opportunities, protect employees' rights, and promote community development and progress [11]. Environmental Aspect: Industries should actively reduce pollution emissions, strengthen ecological environmental protection, and advocate for green production and consumption patterns [12]. Considering all these factors, industries can achieve long-term sustainable development, realizing the multiple goals of economic prosperity, social harmony, and environmental beauty.

DOI: 10.54254/2754-1169/181/2025.22795

3. The basis and direction of integration between tourism and the low-altitude economy based on industrial integration theory

3.1. Industrial foundation of the integration of tourism and the low-altitude economy

3.1.1. Development status and resource advantages of the tourism industry

According to the World Tourism Economic Trends Report (2024), despite a significant global economic slowdown in 2023, the total number of global tourist visits reached 12.673 billion, and total global tourism revenue amounted to $5.5 trillion (5.5% of global GDP). It is forecast that, under baseline conditions, global tourist visits will reach 13.579 billion and global tourism revenue will rise to $5.8 trillion in 2024 [13]. In terms of market structure, domestic tourism dominates due to convenience and abundant resources. The growth of outbound tourism is rapid, reflecting the upgrade in consumer spending and the pursuit of diverse cultural experiences. Inbound tourism attracts overseas visitors through unique cultural and resource offerings. Leisure tourism, focused on relaxation, accounts for a large and steadily growing proportion. China boasts rich natural and cultural tourism resources, with mountains, oceans, and other scenic spots providing low-altitude views. Ancient monuments and folk customs add cultural depth to low-altitude tourism, laying a solid foundation for the integration of tourism and the low-altitude economy.

3.1.2. Development status and industrial characteristics of the low-altitude economy

In recent years, the low-altitude economy has rapidly developed in China and has become a new engine for economic growth. The low-altitude economy is based on low-altitude airspace and centers on the general aviation and drone industries. It covers multiple fields such as general aviation manufacturing, drone technology, and aviation services, characterized by high technological intensity and a strong reliance on aerospace, electronic information, new materials, and other high-tech industries [14]. The low-altitude economy has a strong driving force, significantly stimulating the upstream industries of aviation materials and component manufacturing, as well as the downstream industries of aviation services and training. This strong momentum will facilitate the coordinated development of these industries.

3.1.3. Analysis of industrial connectivity

From a market demand perspective, the pursuit of unique experiences by tourists has led to a growing demand for low-altitude tourism products. The development of the low-altitude economy requires the expansion of application scenarios, with the tourism market being an important direction. In terms of the industrial chain, the tourism industry's elements such as transportation, accommodation, and catering are closely connected with the low-altitude economy's aspects of aircraft manufacturing and operational services. Aircraft manufacturing provides new modes of transportation for tourism, while the demand for food and accommodation in tourism supports low-altitude operations. The two industries are interlinked and mutually supportive, making their integration an inevitable trend in industrial development.

3.2. Directions of integration based on industrial integration theory

3.2.1. Product integration direction

In terms of product integration, aerial sightseeing products focus on customizing special flight routes based on different tourism resources. For natural landscapes such as mountains and canyons, low-altitude shuttle routes are designed to allow tourists to appreciate their grandeur from a unique

DOI: 10.54254/2754-1169/181/2025.22795

perspective. For historic and cultural cities, high-altitude sightseeing routes are planned to offer panoramic views of the city and layout of historic sites, providing multi-angle viewing experiences. Aviation-themed tourism products aim to create comprehensive projects. By building aviation science museums to showcase aviation history and principles, setting up flight simulation experience zones to help tourists dream of the skies, and creating cultural platforms to present the evolution of aviation culture, the industry integrates knowledge popularization, flight experiences, and cultural exhibitions in depth. Aviation sports tourism products focus on innovation in extreme sports tourism. Projects such as skydiving and paragliding, equipped with smart equipment, are developed to enhance safety with advanced navigation and monitoring devices. Additionally, a complete safety training and professional rescue mechanism is constructed, and personalized route planning along with pre-flight VR previews are implemented to enhance the visitor experience.

3.2.2. Market integration direction

In terms of market integration, traditional boundaries between the tourism and low-altitude economy markets need to be broken, adopting a combined online and offline marketing model. Online, big data can be used to analyze tourist demand preferences in depth, accurately recommending low-altitude tourism products. For example, based on tourists' search history and browsing records, outdoor sports enthusiasts could be targeted with aviation sports tourism products, thus improving the precision and efficiency of marketing.

Offline, partnerships can be formed with travel agencies, aviation clubs, and others. Travel agencies, with their wide customer base and service network, and aviation clubs, with their professional resources, can jointly integrate products and services, expanding market space. Additionally, cross-industry marketing activities should be actively organized. By showcasing aircraft, conducting flight performances, and hosting tourism promotional events, aviation elements can be deeply integrated with the tourism experience, attracting more potential customers and promoting market integration.

3.2.3. Industrial organization integration direction

In terms of industrial organization integration, tourism enterprises and low-altitude economy companies can achieve synergy through strategic alliances. Both parties can jointly develop a development plan, clarify market positioning and product layout, share resources such as channels and technology, and reduce operational costs. At the same time, by jointly promoting products and creating a "tourism + low-altitude" branded product, their market competitiveness can be enhanced. Mergers and acquisitions (M&A) are also important modes of integration. Large tourism groups can acquire low-altitude economy companies to quickly expand their business scope and extend the industrial chain. Merging low-altitude economy companies with tourism enterprises can integrate advantageous resources and optimize resource allocation. However, this process may face challenges such as cultural differences and management integration issues. Due to differences in operating concepts and organizational structures, improper integration can lead to inefficiencies. Additionally, there may be external challenges such as policy and regulatory issues, market fluctuations, etc., which require cautious handling.

DOI: 10.54254/2754-1169/181/2025.22795

4. Collaborative innovation path for the integration and development of tourism and the low-altitude economy based on collaborative innovation theory

4.1. Collaboration among innovation entities

4.1.1. Inter-enterprise collaborative innovation

Caissa Tourism and AVIC General Aviation (AGAC) are deeply collaborating in multiple fields. In terms of technological research and development, they focus on ensuring low-altitude tourism safety. AVIC leverages its aviation technology advantages, while Caissa Tourism provides feedback and scenario requirements from tourists, helping to upgrade safety systems like weather monitoring and collision avoidance, addressing the risks of low-altitude flying. When designing products, the two companies integrate resources, combining Caissa Tourism's market knowledge and AVIC's aircraft technology to create the "Island Aviation Exploration Tour." This product merges popular island resources with low-altitude sightseeing, designing unique routes and incorporating aviation science experiences in seaside resorts to enrich the product offerings. In market promotion, both parties engage in joint marketing efforts. Caissa Tourism utilizes both online and offline channels, while AVIC General Aviation attracts target customers through aviation exhibitions and professional media, jointly organizing the "Island Aviation Tourism Festival." The collaboration has achieved remarkable results, with the product's market share increasing by approximately 15% within a year, opening up new profit points for both companies.

4.1.2. Industry-academia-research collaborative innovation

Industry-academia-research collaborative innovation injects vitality into the development of low-altitude tourism. For example, Nanchang Aviation University, the China Helicopter Design and Research Institute, and Jiangxi Express Commute Aviation Co., Ltd. have collaborated on technological innovation, focusing on research projects to reduce noise and improve comfort in low-altitude tourism helicopters. The university provides theoretical support, the research institute translates technology, and the company supplies operational data, working together to optimize products and enhance industry technology levels. Regarding talent development, universities offer relevant courses to build a theoretical knowledge framework, research institutes provide practical platforms to expose students to cutting-edge technologies, and companies participate in designing training programs to ensure that talents meet industry needs. This model has helped reserve a large pool of professionals for the low-altitude tourism industry, significantly driving industry development.

4.1.3. Government and other stakeholders collaboration

The government of Chongzhou City fully considers the needs of various stakeholders when formulating policies for industry integration. They issued the "Measures to Support the High-Quality Development of the Low-altitude Economy," which balances the demands of companies for cost reduction and market expansion, the needs of universities and research institutes for technology transfer, and creates a favorable policy environment. In terms of building communication platforms, the government hosts low-altitude economy development forums, inviting companies, universities, and research institutes to discuss development together. Enterprises use this platform to express their needs, while universities and research institutes present their results, fostering cooperation. Regarding resource allocation, special funds are established to support low-altitude industry projects. Additionally, preferential land policies are implemented to attract projects. The city has signed 15 low-altitude economy projects, covering manufacturing and industry scenarios, pushing forward

DOI: 10.54254/2754-1169/181/2025.22795

collaborative innovation across multiple industries and working towards the national first-tier goal by 2027.

4.2. Mechanisms and safeguards for collaborative innovation

4.2.1. Knowledge sharing mechanism

To establish a knowledge-sharing platform, a combination of online databases and offline seminars can be used. Online databases facilitate storage and retrieval, making them suitable for long-term knowledge accumulation and widespread dissemination. Offline seminars promote face-to-face in-depth exchanges, making them suitable for discussing complex issues. Knowledge sharing through academic exchanges, technology transfer, and other channels can facilitate the flow and conversion of knowledge. Knowledge sharing enhances innovation efficiency and avoids redundant research and development. Reward and honor systems should be established to motivate enterprises, universities, and research institutes to actively participate, promoting collaborative knowledge development within the low-altitude tourism industry.

4.2.2. Benefit distribution mechanism

In collaborative innovation, benefit distribution should comprehensively consider factors such as the resources invested, risks borne, and contributions made by each entity. A share-based distribution has the advantage of motivating investment and is fair and transparent, but may lead to a focus on short-term returns. A contribution-based distribution can stimulate entities to utilize their expertise to improve performance, although assessing contributions can be complex. Negotiation should be used to facilitate communication between all parties and reach a consensus. The distribution rules, including the ratio, method, and conditions, should be clearly defined in a contract to ensure clear rights and responsibilities, promoting enthusiasm and sustainability, and effectively avoiding conflicts.

4.2.3. Risk-sharing mechanism

In collaborative innovation, both technological and market risks exist. On the technology side, there is a high probability of research failure, and rapid technological advancements mean that innovative outcomes may become obsolete if they are not kept up to date. On the market side, demand changes quickly, competition intensifies, and products or services may be defeated if they do not meet needs or have weak competitive edges. Therefore, establishing a risk-sharing mechanism is crucial. It enhances the risk resistance capacity of each entity, preventing the collapse of cooperation due to one party's inability to bear the risks, thus stabilizing the collaboration. Risk can be shared through the following strategies: establishing a risk early-warning system to monitor risks in real-time, introducing insurance mechanisms to transfer part of the risk, and clearly defining the principles for sharing losses based on each party's contribution and agreement. This ensures the steady progress of collaborative innovation.

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5. Principles of sustainable development for the integration of tourism and low-altitude economy

5.1. Economic sustainability principles

5.1.1. Economic benefits of integration development

The integration of tourism and the low-altitude economy significantly enhances economic benefits. In terms of resource utilization, integrating tourism resources with low-altitude facilities, such as using airspace in scenic areas for low-altitude flight projects, improves resource reuse efficiency. Regarding cost control, sharing infrastructure and operational channels reduces construction and marketing costs. At the same time, it creates new economic growth points, such as low-altitude sightseeing and aviation-themed tourist towns, attracting more consumers and expanding the industry's profit space, promoting collaborative development across industries.

5.1.2. Industrial structure optimization and economic transformation

The integration of tourism and the low-altitude economy in Sanya has greatly contributed to regional industrial structure optimization and economic transformation. By utilizing coastal resources for low-altitude sightseeing, it not only enriches the tourism product supply, attracts more tourists, and increases tourism revenue, but also promotes the development of related industries such as aircraft maintenance and personnel training through quality routes like Haitang Bay boutique coastal sightseeing and Wuzhizhou Island aerial flights. This drives the industrial structure from a single tourism model to a "tourism + general aviation services" model. It also facilitates the economic shift from traditional tourism consumption to a diversified, high-end, collaborative industry, enhancing the resilience and sustainability of economic development.

5.2. Social sustainability principles

5.2.1. Employment and talent development

The integration of tourism and the low-altitude economy creates numerous job opportunities. New industries such as low-altitude tourism operations, services, and ground support services absorb labor at various skill levels. At the same time, the integration fosters a demand for interdisciplinary talents who are knowledgeable in both tourism services and low-altitude technology management. This demand drives cooperation between educational institutions and enterprises to develop targeted talent cultivation programs. The influx of these interdisciplinary talents further promotes industry integration, improving operational efficiency and service quality, creating a virtuous cycle between talent development and industry growth, which supports the sustainable development of the industry.

5.2.2. Social and cultural heritage and development

Low-altitude tourism products can incorporate local cultural elements in various ways. Flight routes can connect historical landmarks and distinctive villages, and in-flight commentary can include folk tales and cultural stories. The appearance of aircraft or airports can feature local artistic patterns. This integration allows tourists to experience local culture from a new perspective, enhancing cultural identity and promoting cultural heritage. At the same time, it provides an opportunity for cultural innovation, stimulating the development of cultural creative industries, and leading to new products like aviation-themed cultural souvenirs. This revitalizes ancient cultures within the context of modern tourism, promoting the transmission and development of social culture.

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5.3. Environmental sustainability principles

5.3.1. Environmental protection and ecological friendliness

Low-altitude tourism has a potential impact on the ecological environment. Flight activities may generate noise pollution, disturb wildlife habitats, and aircraft emissions may affect air quality. Therefore, a series of environmental protection measures are required. Noise-reducing technologies, such as low-noise engines, should be applied, and flight routes should be optimized to avoid ecologically sensitive areas. When choosing aircraft, the promotion of clean energy options, such as electric or biofuel-powered aircraft, can reduce carbon emissions. At the same time, environmental education for tourists should be strengthened, and strict environmental supervision regulations should be established to ensure that the negative impact on the ecological environment is minimized while enjoying low-altitude tourism, achieving eco-friendly development.

5.3.2. Rational resource utilization and protection

In the integration of tourism and the low-altitude economy, rational resource utilization and protection are crucial. On the one hand, tourism and low-altitude resources should be integrated, such as utilizing the airspace of well-known scenic spots for low-altitude sightseeing, making efficient use of existing venues and facilities to avoid redundant construction. On the other hand, resource protection should be emphasized. For natural landscape resources, strict limits on flight altitude and range should be set to prevent damage to the ecological environment. For airspace resources, scientific planning and use should be adopted to avoid overcrowding due to excessive development. By establishing resource evaluation and supervision mechanisms, the integration of industries can steadily progress based on sustainable resource use, achieving a win-win situation for both economic development and resource protection.

6. Conclusion and outlook

6.1. Summary of research conclusions

This study, grounded in theories of industrial integration, collaborative innovation, and sustainable development, provides an in-depth exploration of the integration between tourism and the low-altitude economy. The research clearly shows that this integration has a solid industrial foundation. From the perspective of integration directions, there is vast potential in various dimensions such as product, market, and industrial organization. In promoting integrated development, the resource integration between enterprises, in-depth collaboration between industry, academia, and research institutions, and the cooperation between governments and other stakeholders form a powerful synergy. Furthermore, strictly adhering to the principles of economic, social, and environmental sustainability is not only the key to achieving industrial integration but also an important guarantee for realizing long-term sustainable development goals. These insights carry significant implications for the future trajectory of the industry.

6.2. Future research outlook

Future research can be deepened in multiple directions. First, a focus on the application of new technologies, such as artificial intelligence and big data, in the precise marketing and intelligent management of low-altitude tourism. Second, expanding research on international markets to explore the industrial integration models in different countries and regions, providing strategies for international development. Third, paying attention to policy dynamics and studying the impact of policy adjustments on integrated development, helping the industry seize policy opportunities. Fourth,

DOI: 10.54254/2754-1169/181/2025.22795

strengthening interdisciplinary research by integrating economics, sociology, and other disciplines to comprehensively analyze the complex effects of integrated development.

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