

Exploration of the Path for Low-Altitude Economy to Empower the High-Quality Development of Cultural Tourism

-- A Case Study of Yan'an City, Shaanxi Province

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Abstract: Against the dual background of the low-altitude economy emerging as a national strategic emerging industry and the continuous upgrading of cultural tourism demands, Yan'an, as a core national cultural tourism destination, holds significant demonstration value for the integrated development of its low-altitude economy and cultural tourism. Combining the theoretical logic of the integration of the low-altitude economy and the cultural tourism industry, this paper sorts out Yan'an's cultural tourism resource endowments and the development foundation of the low-altitude economy, analyzes the current practical dilemmas faced by Yan'an's low-altitude tourism, such as rigid airspace management mechanisms, insufficient industrial format innovation, and weak infrastructure. It further proposes a path for the integrated development of "low-altitude + cultural tourism" from four dimensions: policy coordination, industrial format innovation, infrastructure improvement, and market cultivation. This study aims to provide a reference for Yan'an to build a new growth pole of red cultural tourism and promote the transformation and upgrading of the regional cultural tourism industry.

Keywords: Low-altitude Economy; Red Cultural Tourism; Industrial Integration; Yan'an; Development Path.

1. Introduction

In recent years, leveraging the advantages of "spatial breakthrough and scenario innovation", the low-altitude economy has become a new engine empowering the high-quality development of the cultural tourism industry. The 2024 Government Work Report clearly identifies the low-altitude economy as a national strategic emerging industry [1], and the Third Plenary Session of the 20th Central Committee of the Communist Party of China calls for the cultural tourism industry to break through the bottlenecks of "homogenization and superficialization" [2]. This integration trend stems not only from the promotion of national strategies but also responds to the market demand for "immersive and diversified" experiences. Moreover, it aligns with the appeal of cultural tourism destinations to address development bottlenecks and seek industrial breakthroughs, providing a new path for the transformation of regional cultural tourism from "traditional sightseeing" to "high-quality experience".

At the policy level, the deepening national requirements for the high-quality development of cultural tourism have elevated low-altitude flight from a "transportation function" to a core carrier for reconstructing cultural tourism experiences. At the market level, tourist demands have shifted towards "in-depth immersion and three-dimensional perception". Traditional ground-based cultural tourism struggles to present the systematic connections of resources,

making the low-altitude economy a key driver for industrial format innovation.

Focusing on Yan'an, as a core national red cultural tourism destination, it boasts diverse resources including "red culture, natural ecology, and historical humanities". However, the development of cultural tourism faces obvious shortcomings: first, traditional ground-based sightseeing focuses on popular scenic spots, while remote resources such as Nanniwan are underdeveloped due to topographical constraints, resulting in a dilemma of "abundant resources but uneven utilization"; second, the lack of innovative experiences and insufficient penetration of digital technologies and emerging industrial formats make it difficult to meet the demand for "in-depth experiences". The introduction of the low-altitude economy can break spatial limitations, innovate experience forms, and inject new vitality into Yan'an's cultural tourism.

Based on this, taking Yan'an City as the research object, this paper combines the theoretical logic of the integration of the low-altitude economy and the cultural tourism industry, systematically sorts out Yan'an's cultural tourism resource endowments and the development foundation of the low-altitude economy, conducts an in-depth analysis of practical dilemmas, and finally proposes targeted path suggestions from four dimensions. It aims to provide practical reference for Yan'an to build a new growth pole of the cultural tourism industry and offer valuable experiences for other similar cultural tourism destinations.

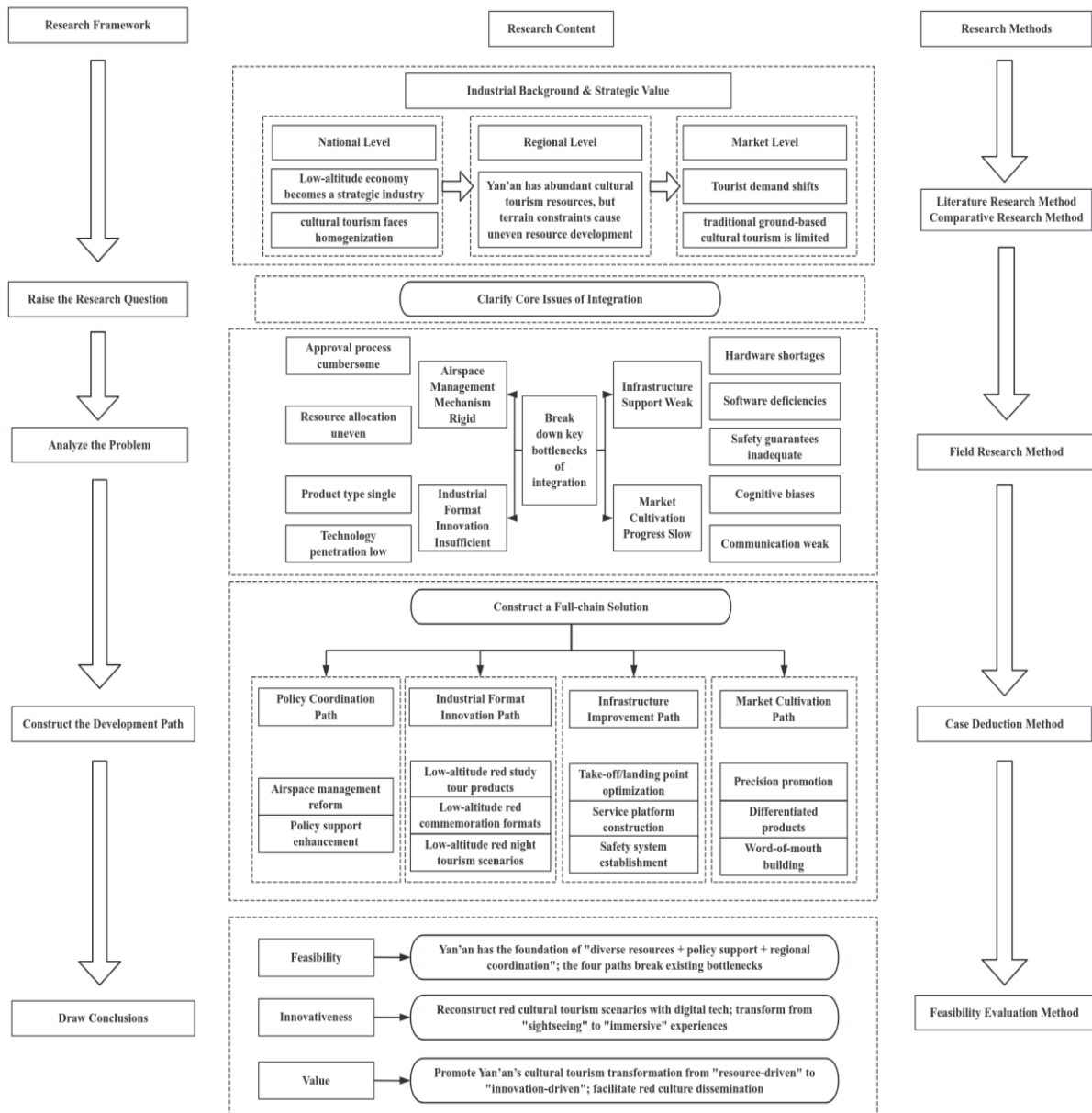


Figure 1. Technical Route Chart

2. Basic Conditions for the Integrated Development of Low-Altitude Economy and Cultural Tourism in Yan'an

Yan'an's diverse cultural tourism resource endowments and the initial development of the low-altitude economy mutually support each other, forming a multi-dimensional system of "resource guarantee - facility support - policy guidance - regional coordination". This has opened up broad space for the integration of the low-altitude economy into various cultural tourism scenarios.

2.1. Yan'an's Cultural Tourism Resource Endowments

As a comprehensive cultural tourism destination, Yan'an possesses a large-scale cultural tourism resource base, prominent brand influence, and spatial characteristics compatible with low-altitude perspectives, providing a natural scenario foundation for the empowerment of the low-altitude economy.

2.1.1. Diverse Resource Types and Strong Spatial Compatibility

Yan'an boasts a rich and comprehensive matrix of cultural tourism resources, covering red cultural tourism resources (445 revolutionary sites, 19 revolutionary memorial halls), natural ecological resources (Hukou Waterfall of the Yellow River, loess plateau gully landforms, etc.), and historical and humanistic resources (Huangdi Mausoleum, Qingliangshan News Memorial Hall, etc.). These resources exhibit spatial characteristics of "scattered points, long connecting lines, and wide coverage". Ground-based tours are prone to "experience fragmentation" due to topographical barriers, while low-altitude flights can realize the systematic presentation of diverse resources through "airborne connection", providing a unique foundation for the development of "low-altitude cultural tourism routes".

2.1.2. Strong Brand Influence and Stable Tourist Source

Yan'an's cultural tourism brand enjoys high recognition nationwide. In 2023, it received 41.988 million cultural tourists, showing a significant market recovery momentum [4]. The number of tourists has grown from 413,000 in 1995 to 73.083 million in 2019, an increase of over 180 times in

more than 20 years. Even after the impact of the epidemic, it has recovered rapidly, confirming its sustained attractiveness. The tourist groups include students on study tours, leisure travelers, and cultural enthusiasts, providing a stratified market for low-altitude cultural tourism.

2.1.3. Clear Policy Support and Strong Assistance

Yan'an has established a three-level policy support system of "top-level planning - special policies - factor guarantee". The 14th Five-Year Plan for Cultural Tourism Development proposes to "innovate cultural tourism formats and promote the integration of cultural tourism with emerging industries". The 2025 Government Work Report lists the low-altitude economy as a strategic emerging industry, emphasizing the expansion of new formats such as low-altitude tourism. Supporting documents such as the "Nine Policies of Qinchuangyuan (Yan'an) Innovation Promotion Center" provide preferential treatment for relevant enterprises in terms of land, funds, and talents, lowering the threshold for the implementation of low-altitude cultural tourism projects.

2.2. Development Foundation of Yan'an's Low-Altitude Economy

Yan'an's accumulations in general aviation facilities, pilot practices, and regional coordination have improved the hardware support and experience reserves for the low-altitude economy to empower cultural tourism, providing implementable conditions for the low-altitude transformation of cultural tourism scenarios.

2.2.1. Initial Layout of General Aviation Facilities and Improved Carrying Capacity

As of June 2025, the infrastructure and planning layout of Yan'an's low-altitude economy have taken initial shape. The municipal government has launched the compilation of the 15th Five-Year Plan for the Development of the Low-Altitude Economy, and the transformation of Yan'an Airport into a low-altitude flight station has been included as a key project [7]. Currently, there are two major development zones (High-tech Zone and New Area), as well as multiple concentration areas and demonstration parks, forming a diversified enterprise cultivation ecosystem and enhancing the investment undertaking capacity for low-altitude economy-related projects [5].

2.2.2. Mature Pilot Cases with Strong Reference Value

The low-altitude tour project at Hukou Waterfall in Yichuan serves as a benchmark practice. Launched in June 2019, it utilizes helicopters to design a 16-kilometer exclusive route around the core landscape, adopting aircraft models that carry 4 tourists per flight and dynamically adjusting the reception capacity. Market feedback indicates that the experience brought by the aerial perspective far exceeds that of traditional ground-based tours. It has also formed an industrial linkage effect of "low-altitude tours + ground services", driving the income growth of surrounding supporting industries and providing a practical sample for the development of full-region low-altitude cultural tourism.

2.2.3. Significant Regional Coordination Advantages and Strong Resource Support

Yan'an can rely on Shaanxi Province's low-altitude economy industrial foundation and transportation network to obtain technical, equipment, and talent support. In 2024, Shaanxi Province issued a relevant action plan to build a "one core and seven chains" industrial cluster, and Nanniwan and Huangling General Aviation Airports in Yan'an have been

incorporated into this network [6]. Yan'an has planned and reserved 58 low-altitude economy projects with a total investment of 5.403 billion yuan. The industrial ecosystem of Xi'an Yanliang Aviation Economic and Technological Development Zone, the cooperation between Huangling General Aviation Airport and Northwestern Polytechnical University, and the technological upgrading of Yan'an Mingzeyuanjin Technology Co., Ltd. have further consolidated the technical and talent foundation [11].

3. Practical Dilemmas in the Integrated Development of Low-Altitude Economy and Red Cultural Tourism in Yan'an

Based on the three-dimensional information source analysis of "regional practice - national reference - theoretical traceability", this paper identifies four major practical dilemmas in the integration of Yan'an's low-altitude economy and red cultural tourism:

3.1. Rigid Airspace Management Mechanism and Insufficient Adaptability to Cultural Tourism

3.1.1. Complex Approval Processes, Unable to Meet the Immediate Needs of Cultural Tourism

China implements a "classified and hierarchical" low-altitude airspace management model. However, in practical operations, applications require approval from multiple departments, with cumbersome processes and no unified standards [11]. Yan'an adopts a "pre-approval" mechanism. The application for low-altitude cultural tourism routes involves coordination with multiple departments, and the approval cycle can be as long as 1-2 months. This fails to meet tourists' needs for "immediate booking and flexible experience" and is also difficult to adapt to the sudden growth of tourist flow during peak seasons.

3.1.2. Uneven Allocation of Airspace Resources, Restricting the Expansion of Cultural Tourism Scenarios

The airspace in some core areas of Yan'an is subject to safety control restrictions, making it difficult to develop comprehensive routes such as "inter-provincial low-altitude waterfall viewing + red study tours". This leads to the characteristics of "singleness and fragmentation" in low-altitude cultural tourism scenarios.

3.2. Insufficient Industrial Format Innovation and Lack of In-depth Integration with Cultural Tourism

3.2.1. Single Industrial Format, Failing to Cover Diversified Cultural Tourism Needs

Currently, Yan'an's low-altitude flight business is concentrated in traditional fields such as agricultural and forestry operations and short-distance transportation. The implemented low-altitude cultural tourism pilots mainly focus on "natural landscape sightseeing", with insufficient exploration of red cultural tourism and historical cultural tourism scenarios, failing to form a differentiated pattern [3].

3.2.2. Insufficient Penetration of Digital Technologies and Weak Cultural Tourism Experience

Existing low-altitude cultural tourism projects lack empowerment by technologies such as AR/VR and digital

twins, making it difficult to achieve immersive experiences of "low-altitude flight + cultural scene reproduction". They have not been deeply integrated with the cultural connotations of cultural tourism resources, and thus struggle to arouse tourists' emotional resonance and cultural identity.

3.3. Weak Infrastructure and Limited Support Capacity for Cultural Tourism

3.3.1. Insufficient Quantity of Hardware Infrastructure and Misalignment with Cultural Tourism Nodes

There is a shortage of "hard infrastructure" required for the low-altitude economy, such as take-off and landing sites and charging facilities. Less than 30% of the country's low-altitude airspace is used for general aviation, and it is not connected into a network [14]. In Yan'an, only Nanniwan and Huangling General Aviation Airports have mature take-off and landing conditions. Temporary take-off and landing points have not been planned at key nodes such as Yangjialing and Zaoyuan, and the supporting facilities of existing take-off and landing sites are insufficient, restricting large-scale operations [12].

3.3.2. Lack of Standards in Software Infrastructure and Insufficient Data Coordination

A unified system has not been formed for "soft infrastructure" such as the construction of low-altitude intelligent networks and data security management. There is a lack of clear industry standards, making it difficult for equipment and service platforms of different enterprises to interconnect and intercommunicate. The lack of data security specifications has further exacerbated the fragmentation of "soft infrastructure".

3.3.3. Lack of Functions in Supporting Service Facilities and Insufficient Safety Guarantee

No specialized low-altitude cultural tourism service platform has been built, resulting in cumbersome operations for tourists. There are loopholes in emergency support in core cultural tourism areas. Along the low-altitude route of Hukou Waterfall of the Yellow River, there are few emergency take-off and landing points with insufficient equipment, and none have been planned around Yangjialing, posing potential safety risks and restricting the release of market demand [13].

3.4. Low Market Awareness and Difficulties in Cultivating Cultural Tourism Groups

3.4.1. Tourists' Cognitive Biases and Restricted Consumption Willingness

Most tourists equate low-altitude cultural tourism with "high-end consumption". Influenced by the 398-yuan one-way ticket price of the Hukou Waterfall project, they consider the products "beyond their affordability". Meanwhile, Yan'an's main cultural tourism groups (student study tours and middle-aged and elderly leisure travelers) are price-sensitive. Some tourists also have concerns about the safety of low-altitude aircraft, especially regarding flight safety over special terrains, which reduces their consumption willingness.

3.4.2. Weak Promotion System and Limited Market Coverage

Yan'an has not yet built a specialized marketing system for "low-altitude + cultural tourism". Existing communication mainly relies on spontaneous word-of-mouth, and its popularity is limited to local and surrounding tourist groups. The communication carriers are mainly "WeChat, Weibo, and official apps", making it difficult for tourists to obtain product

information through mainstream new media channels, which further exacerbates the problem of low market awareness [9].

4. Path Suggestions for the Integrated Development of Low-Altitude Economy and Red Cultural Tourism in Yan'an

4.1. Policy Coordination: Building a Flexible Airspace Management and Support Mechanism

4.1.1. Promoting Airspace Management Reform: Establishing a Cultural Tourism-Adapted Management System

Establish a cultural tourism-adapted management system. Yan'an, in conjunction with the Shaanxi Provincial Air Traffic Control and Cultural Tourism Departments, should set up an "Yan'an Red Low-Altitude Cultural Tourism Exclusive Airspace" based on the national policy framework, implementing a "classified management and dynamic adjustment" mechanism. It should clarify standards such as a flight altitude of 100-300 meters and a one-way distance not exceeding 20 kilometers, simplify application materials, cancel unnecessary verification links, and realize "application on the same day and flight on the next day". The approval process can be optimized by drawing on the experience of the Hefei Luogang Full-Space Unmanned System Demonstration Project [18].

4.1.2. Increasing Policy Support: Strengthening Policy Supply for Market Cultivation

Establish a "Special Fund for Low-Altitude Red Cultural Tourism" to provide subsidies for equipment purchase, construction of temporary take-off and landing points, and rewards for innovative product revenue. Launch "low-altitude red cultural tourism consumption vouchers" to enhance the consumption willingness of target groups.

4.2. Industrial Format Innovation: Building an In-depth Integrated Product System of "Low-Altitude + Red"

4.2.1. Developing "Low-Altitude Red Study Tour" Products

Combine the revolutionary historical context with students' needs to design themed study tour routes such as "Nanniwan - Yangjialing". Equip aircraft with customized VR devices, embed digitally restored content of historical scenes, and provide real-time explanations to achieve the triple effects of "aerial viewing + historical reproduction + spiritual inheritance".

4.2.2. Innovating "Low-Altitude Red Commemoration" Formats

Launch "cloud-based red commemoration activities" on important anniversaries, such as the "cloud-based Party admission oath" on the Party Founding Day. Organize new Party members to take low-altitude aircraft and swear an oath over Baota Mountain, forming an "air + ground" linkage. Draw on the experience of Jinggangshan's "cloud-based martyr commemoration" project to enhance the participation in the dissemination of red spirit.

4.2.3. Creating "Low-Altitude Red Night Tour" Products

Rely on night red cultural tourism resources to develop low-altitude night tour routes such as "Baota Mountain Light

Show - Both Banks of the Yanhe River". Select aircraft equipped with special lighting equipment and directional sound systems, and cooperate with cultural explanations to achieve in-depth integration of visual experience and cultural interpretation.

4.3. Infrastructure Improvement: Building a Support System of "Take-off and Landing + Services + Safety"

4.3.1. Optimizing the Layout of Take-off and Landing Points

In accordance with Shaanxi Province's relevant plans, plan and construct 3-5 temporary take-off and landing points in core red cultural tourism areas. Adopt a "small-scale and modular" design, control the floor area to 1000-1500 square meters to reduce construction costs, strengthen connection with scenic spots, and realize seamless connection between "flight + ground tour" [8].

4.3.2. Building an Integrated Service Platform

Establish the "Yan'an Low-Altitude Red Cultural Tourism Service Center". Develop WeChat mini-programs and APPs online to provide services such as product booking and route inquiry, supporting package purchases. Set up offline service stations to provide physical services such as safety training, and connect to Shaanxi Province's low-altitude economy data center to achieve data interconnection and intercommunication.

4.3.3. Improving Safety and Rescue Facilities

Set up 1 emergency take-off and landing point every 5-8 kilometers along low-altitude routes, equipped with basic rescue equipment. Collaborate with multiple departments to establish a "low-altitude tourism emergency rescue linkage mechanism", clarify response procedures, and build a solid safety defense line.

4.4. Market Cultivation: Enhancing Awareness and Attractiveness from Multiple Dimensions

4.4.1. Targeted Promotion and Publicity

Cooperate with mainstream media and industry platforms to produce promotional videos, focusing on core experiences to enhance communication attractiveness. Combine red cultural tourism festivals and events to plan "Low-Altitude Red Experience Days", inviting tourists to experience short-distance flights for free, forming a communication closed loop of "festival drainage + experience transformation".

4.4.2. Launching Differentiated Packages

Based on the characteristics of the tourist group structure, design "low-altitude red study tour packages", "parent-child low-altitude red experience packages", and "Party building low-altitude group building packages" to meet the needs of diverse tourist groups.

5. Conclusions and Prospects

5.1. Research Conclusions

Yan'an already possesses the basic conditions for the integration of the low-altitude economy and cultural tourism, including diverse and adaptable cultural tourism resources, clear policy support, initial low-altitude facilities, and regional coordination advantages. However, it still faces dilemmas such as rigid airspace management, insufficient industrial format innovation, weak infrastructure, and low

market awareness. The four paths proposed in this paper—policy coordination, industrial format innovation, infrastructure improvement, and market cultivation—can address the existing bottlenecks and provide core momentum for the transformation of Yan'an's cultural tourism from "resource-driven" to "innovation-driven".

5.2. Future Prospects

In 2025, China's low-altitude economy will enter the "year of large-scale application", with the acceleration of eVTOL airworthiness certification and commercialization, providing opportunities for Yan'an's integrated development [10]. In the future, breakthroughs can be made towards "intelligentization and networking" [15]: at the intelligentization level, rely on technologies to build an intelligent operation system, realizing the in-depth integration of "aerial viewing - virtual reproduction - cultural perception" of red sites; at the networking level, take the lead in cooperating with other red destinations such as Xibaipo and Jinggangshan to promote inter-provincial cooperation, strive for national-level route pilots, develop inter-provincial routes of "retracing the revolutionary path", and realize "one-stop booking and full-region flight". This will form a national low-altitude red tourism network, helping Yan'an become a demonstration sample for the integration of the low-altitude economy and characteristic cultural tourism nationwide.

Acknowledgments

This work is supported by Research Project of National Xi'an International Studies University Students Innovation and Entrepreneurship Training Program Project, Project Number:202510724054.

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