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A Review of Research on Development Conditions and Regional Evaluation of Low-Altitude Tourism in China

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ABSTRACT
This paper systematically reviews relevant domestic and international literature, examining the current state of research on China's low-altitude tourism development conditions and regional evaluation from perspectives including low-altitude tourism itself, its development prerequisites, and regional tourism development assessment. Findings reveal that existing studies predominantly focus on single regions or specific case studies, lacking a systematic nationwide assessment of low-altitude tourism development conditions. This deficiency hinders the provision of scientific basis for regionally differentiated development. Therefore, future research on low-altitude tourism development conditions and regional evaluation should establish a multi-level indicator system encompassing natural climate conditions, socioeconomic conditions, tourism resource conditions, and infrastructure conditions. Expanding and deepening research in these areas will provide theoretical guidance and practical references for promoting high-quality development of low-altitude tourism and advancing the coordinated upgrading of the general aviation industry and tourism sector.

KEYWORDS
Low-altitude tourism; Development conditions; Tourism development evaluation

1 Introduction

Since the 12th Five-Year Plan period, the state has successively introduced multiple policy measures to encourage the development of low-altitude tourism. From its initial inclusion in tourism reform initiatives in 2014 to being designated as a task for integrated transportation-tourism development in 2017, and from its first incorporation into national development plans as part of the low-altitude economy in 2021 to being positioned as a strategic emerging industry in the 2024 Government Work Report, decades of incremental advancement and continuous policy refinement have fostered a favorable environment for the sustained growth of the low-altitude tourism sector. The low-altitude tourism market has now entered a phase of rapid growth. According to the Civil Aviation Administration of China's 2024 General Aviation and Small Transport Operations Overview, short-distance sightseeing flights accounted for the largest share of national flight operations in 2024.

However, behind the fervor of local governments competing to develop low-altitude tourism projects, significant disparities exist across regions in terms of resource endowments, market environments, infrastructure, and policy frameworks. Blind development could lead to resource wastage and market imbalances. Therefore, comprehensively analyzing the development conditions for low-altitude tourism across China's regions and scientifically assessing their resource suitability and development potential holds significant theoretical value and practical urgency for optimizing industrial layout, mitigating investment risks, and achieving high-quality development in low-altitude tourism.

2 Research on low-altitude tourism

Given the lack of consensus within academia regarding the English terminology for "low-altitude tourism," this study systematically reviewed literature using related terms such as "low-altitude tourism," "air tour," "aircraft tour," "adventure tourism," "general aviation tourism," "air sports tourism," and "scenic flight tour." The search results indicate that specific research findings on low-altitude tourism remain relatively limited. Currently, related studies on low-altitude tourism focus on five key areas:

2.1 Basic characterization of low-altitude tourism

The concept of low-altitude tourism is typically defined based on spatial dimensions and activity formats, referring to sightseeing activities conducted within low-altitude airspace using general aviation transportation, general aviation aircraft, and low-altitude aircraft. Domestic research emphasizes its policy-driven nature and regional economic value, viewing low-altitude tourism as a direct outcome of China's low-altitude airspace management reforms and general aviation industry development. It possesses the integrated characteristics of "transportation + tourism," capable of transcending traditional geographical constraints (Bi & Gai 2018). International research, however, focuses more on its

technological innovation and unique experiential qualities (BradleyRink 2017). Low-altitude tourism can be diversified based on experience modes, tourism system architecture, scenic attractions, and visitor demands. Currently, due to cost-driven price points (Shu 2021), it predominantly targets the high-end tourism market, with limited recognition in the mass market.

2.2 Low-altitude tourism products

To meet diverse visitor demands for aerial experiences, low-altitude tourism products are primarily categorized into five types based on functionality and experience: low-altitude sightseeing tours, low-altitude experiential tours, low-altitude adventure tours, low-altitude themed tours, and low-altitude business tours (Liu 2015). Domestic research on low-altitude tourism products has primarily focused on three areas: supply-demand coupling and iterative innovation (Luo 2023), development and marketing (Xiong 2019), and product upgrades and service innovation (Yan & Lu 2017).

2.3 Market demand and consumer behavior in low-altitude tourism

Understanding consumer participation motivations and behavioral patterns is crucial for advancing the market development of low-altitude tourism. Consumer awareness of low-altitude tourism, willingness to consume, and purchasing power are key factors influencing participation behavior (Wang 2020). Concurrently, improvements in the policy environment and tourism resources have also stimulated consumer demand for low-altitude tourism. Service quality is a key determinant of visitor satisfaction in low-altitude tourism. For instance, the quality of hot air balloon travel experiences directly correlates with visitor satisfaction and happiness (SerkanBertan 2020). Service quality in low-altitude tourism requires further optimization to enhance visitor satisfaction.

2.4 Safety and risk management in low-altitude tourism

The safety of low-altitude tourism activities heavily relies on effective risk management strategies, as their accident rates are higher compared to other commercial aviation operations, particularly in environments lacking stringent regulation (Sarah-BlytheBallard 2014). Relevant studies indicate that enhancing flight monitoring, implementing rigorous pilot training, and elevating maintenance standards can significantly improve the safety of low-altitude tourism activities. Consumers often prioritize safety as a key factor when selecting low-altitude tourism programs. Modern equipment and standardized training have effectively reduced accident and injury rates in high-risk activities like skydiving, thereby boosting consumer trust and satisfaction (ChristianeBarthel, SachaHalvachizadeh, Gamble, Hans-ChristophPape, & ThomasRauer 2023). Consequently, enhancing safety in low-altitude tourism depends not only on technological and equipment advancements but also critically on the implementation of management strategies and regulatory rigor. These factors directly influence public participation willingness and the healthy development of the market.

2.5 Development prospects for low-altitude tourism

With the backdrop of national policy support and ongoing reforms in low-altitude airspace management, various regions are actively developing low-altitude tourism industries to promote the coordinated growth of tourism and general aviation. Market analysis indicates that China's low-altitude tourism sector holds significant potential, yet requires improvements in foundational infrastructure, integrated digital-intelligence empowerment systems, and a chain-based low-altitude tourism framework (Kuang 2022). Regions can leverage their unique resource endowments to deepen the integration of general aviation with distinctive tourism offerings, thereby enhancing regional competitive advantages through differentiated tourism strategies (Mao, Luo, Yue, Yan, & Kamaiyi 2021).

3 Research on conditions for low-altitude tourism development

Current direct research on the conditions for low-altitude tourism development remains limited. Existing findings predominantly focus on single dimensions such as meteorological factors and infrastructure, which fall short of meeting the requirements for systematic evaluation. Consequently, relevant literature on tourism development conditions has been collected for reference.

3.1 Natural climate conditions

Meteorological conditions are critical factors affecting low-altitude flight safety, influencing the entire process from takeoff to landing. Unlike medium-to-high altitude flights and medium-to-large transport aviation activities, which are

significantly affected by weather only during takeoff and landing phases, low-altitude flights operate continuously within an atmosphere characterized by strong convection and rapid changes. This environment significantly impacts flight safety, comfort, route planning, and scenic quality (Ye, Zhou, Dai, Deng, & Gao 2024). Research on meteorological conditions for general aviation aircraft and low-altitude flight remains relatively limited. Existing studies indicate that low-level turbulence is closely related to terrain, temperature differences, and wind speed (Liu, Zhang, Chen, & Sun 2019). Wind speed, low clouds, temperature, visibility, and severe weather (such as lightning and icing) pose major threats to flight operations, particularly in ultra-low-altitude and unmanned aircraft operations. Wind speed, visibility, and extreme weather are widely used as risk assessment indicators (Bao et al. 2024). Furthermore, natural climate conditions serve as fundamental environmental factors for tourism development research, determining the optimal visiting seasons for tourist destinations, the comfort level of visitor experiences, and the feasibility of specific tourism activities (FatemehNourmohammadi, Najafabadi, & BelénGómez-Martín 2023; Yuan, Li, Zhao, Wang, & Luo 2022).

3.2 Infrastructure conditions

As a quintessential example of new-quality productive forces, the development of the low-altitude economy hinges on robust infrastructure support. The construction of general aviation airports and flight camps not only enhances the accessibility of low-altitude tourism but also fosters coordinated regional tourism development (Wang & Wei 2022). The insufficient number and uneven distribution of such facilities remain key constraints on the growth of low-altitude tourism. Therefore, sustained innovation in infrastructure technology, management, and operational models must be promoted through policy support. Regions should leverage their unique tourism resources and general aviation industry strengths to foster deep integration between infrastructure development and the low-altitude tourism sector (Mao et al. 2021).

3.3 Tourism resource conditions

Tourism resources constitute the core element of tourism development, with their quality, scale, and combination characteristics directly influencing a destination's appeal. Traditional evaluations primarily rely on the standard "Classification, Survey, and Evaluation of Tourism Resources (GB/T 18972-2017)", emphasizing resource abundance, scarcity, and integrity. Recent research, however, places greater emphasis on quantitative analysis. Research indicates that the concentration of scenic areas significantly impacts regional tourism appeal. High-grade scenic areas can effectively drive regional tourism economic development by accelerating the spatial clustering of the tourism industry, promoting infrastructure construction, and fostering the growth of supporting services such as accommodation and catering. This creates a logical chain of transmission for regional tourism economic growth (Wang & Song 2024).

3.4 Socioeconomic conditions

The socioeconomic system serves as the foundation and driving force for low-altitude tourism development. The quality of economic operations primarily reflects the developmental achievements attained during tourism industry growth, as well as the stability and sustainability of tourism development (Xu 2021). This encompasses the destination's level of economic development, residents' income levels, consumption habits, policy support, and degree of openness to the outside world. Research indicates that economic development levels and growth in residents' income exert a significant positive driving effect on the tourism economy (X. Zhao 2023); per capita disposable income exhibits a significant positive correlation with total tourism revenue (Y. N. Zhao 2023). Furthermore, policy stability has been demonstrated as a crucial factor influencing tourism investment (FreyaHiggins-Desbiolles & RaoulBianchi 2024).

4 Research on tourism development condition assessment

Tourism development condition assessment serves as a core component of regional tourism planning and management. Its objective is to systematically analyze regional natural, economic, social, and policy environments to reveal tourism development potential and constraints, thereby providing theoretical foundations for tourism planning and sustainable development. Research on tourism development condition evaluation broadly encompasses diverse geographic spatial units and tourist destinations, with subjects spanning ecotourism, rural tourism, smart tourism, cruise tourism, and other tourism types. Evaluation methods increasingly integrate quantitative analysis with interdisciplinary theories (Liang 2024; Zhang 2022). Regarding research content, scholars have designed diverse and refined evaluation systems based on location theory, tourism system theory, sustainable development theory, resource endowment theory, and other relevant frameworks. These systems assess tourism development conditions from multidimensional

perspectives—including natural climate, socioeconomic factors, tourism resources, and infrastructure—tailored to the specific realities of different regions (Chen 2023; Zhang, Dong, Yang, Hu, & Yu 2022). The goal is to accurately reflect the current status and potential of regional tourism development through scientifically sound and rational indicator systems.

5 Conclusion

Overall, research on low-altitude tourism remains in its infancy both domestically and internationally. While some studies have emerged, their quantity remains limited. Existing research exhibits certain limitations in theoretical frameworks, scope, and methodologies: ① Scholars primarily examine low-altitude tourism through perspectives such as conceptual definitions, product systems, market environments, and development prospects. Research angles tend to be broad, content leans toward macro-level analysis, and descriptions of phenomena predominate, lacking in-depth exploration of specific issues. Some studies focus mainly on economic benefit analysis while relatively few address cultural and social impacts. ② Many studies rely on single case analyses or data from specific regions, limiting the generalizability of findings. ③ Current research predominantly employs qualitative methods, with insufficient emphasis on quantitative data collection. This imbalance may result in theoretical frameworks that are one-sided and practical applications that are limited.

Conversely, research on tourism development conditions and regional tourism evaluation has matured both domestically and internationally. Research content has diversified, and methodologies continue to innovate. This expansion of research scope and refinement of methodologies provide a rich foundation of case studies and technical support for future investigations into the development conditions of low-altitude tourism.

6 Discussion

To advance research on the development conditions and regional evaluation of low-altitude tourism in China, future studies may establish a multi-level indicator evaluation system for low-altitude tourism development conditions. This system should encompass dimensions such as natural climate conditions, socioeconomic conditions, tourism resource conditions, and infrastructure conditions. Within natural climate conditions, indicators like temperature, precipitation, wind speed, and visibility can be selected to quantify the impact of regional climate on low-altitude flight safety and airworthiness. For socioeconomic conditions, indicators like tourism revenue, tourist numbers, per capita GDP, permanent resident population, and urbanization rate can reflect regional consumption capacity and market demand. Regarding tourism resource conditions, metrics such as the number of landform types, quantity and quality of scenic areas, and their concentration can measure the endowment of low-altitude tourism landscape resources and spatial linkage potential. Infrastructure conditions may be assessed using indicators such as supporting facilities, number of general aviation airports, and number of aviation flight camps to evaluate hardware support capabilities for low-altitude tourism. Furthermore, the evaluation indicator system for low-altitude tourism development conditions should be optimized based on this framework. Appropriate research methodologies should be employed to measure and analyze the development conditions of low-altitude tourism across China's regions, thereby enhancing the timeliness of the model and the precision of strategies.

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