Research on High-Quality Development of the Low-Altitude Economy

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Abstract: Amidst the deepening new technological revolution and industrial transformation, the low-altitude economy — an emerging sector integrating aerospace, the digital economy, and the real economy — has become a crucial driver for cultivating new quality productive forces. This study systematically elucidates the value implications of high-quality development in this field and identifies key bottlenecks across China's current institutional supply, technological innovation, scenario application, infrastructure, and talent support systems. Employing a qualitative analysis framework, the research proposes a six-dimensional pathway focusing on institutional optimization, technological breakthroughs, scenario expansion, infrastructure perfection, talent cultivation, and collaborative governance. The findings reveal that coordinated policy incentives, core technology self-reliance, and diversified application ecosystems are fundamental to unlocking the sector's potential. The study concludes that a holistic governance approach is essential to transition the low-altitude economy from pilot exploration to scaled growth. These insights offer theoretical reference and practical guidance for policymakers and stakeholders aiming to foster sustainable and high-quality development in this strategic industry.

***Keywords*:** low-altitude economy; high-quality development; new quality productive forces; industrial ecosystem; airspace governance

1. Introduction

The 20th CPC National Congress and the 2024 Government Work Report highlight the low-altitude economy as a strategic emerging industry vital for national development. This study explores how to build a high-quality development pathway for the low-altitude economy suited to China's conditions.

Existing research provides multidimensional theoretical explanations of the low-altitude economy from perspectives such as technological economics, Marxist political economy, and geography. Studies have focused on conceptual definitions[1][2][3], regional development models[4], and its relationship with urban governance and industrial integration[5][6]. Academics generally define it as an emerging economic form that takes low-altitude airspace as a key production factor, uses aircraft like drones and eVTOLs as core carriers, relies on deep interaction between the low-altitude environment and human activity, and achieves integration of economic, social, and ecological value through technological innovation and industrial synergy. In application scenarios, literature indicates that the low-altitude economy, through technologies such as drone remote sensing, IoT, and big data, can enhance refined urban management efficiency, promote the transformation of ecological product value, foster cultural-tourism integration, and cultivate new quality productive forces[7]. However, existing research rarely examines the low-altitude economy systematically from a "high-quality development" perspective. This paper aims to address this gap through a structured analysis of its value implications, practical obstacles, and optimization pathways.

2. The Value Implications of High-Quality Development of the Low-Altitude Economy

The low-altitude economy is an emerging economic system centered on low-altitude airspace, utilizing drones and eVTOLs as key carriers, and integrating advanced manufacturing, digital technologies, and service sectors. Its high-quality development drives industrial upgrading, regional structural optimization, and governance modernization.

(1) Value of Spatial Restructuring.

It overcomes terrain and infrastructure barriers by establishing an "air+ground" 3D transport network, enhancing accessibility. Drones enable point-to-point delivery in remote areas, reducing costs and bridging urban-rural gaps. This fosters polycentric regional growth and supports cross-border trade, island supply, and emergency rescue.

(2) Value of Technological Innovation.

As a technology-intensive field, it advances high-density batteries, autonomous systems, and integrated communications. Innovations improve aircraft safety, operational intelligence, and service efficiency. eVTOL development, for instance, stimulates cross-disciplinary progress and industrial chain growth. Mature technologies may position it as a strategic frontier

like high-speed rail, elevating China's global industrial role.

(3) Value of Governance Modernization.

Using air-space-ground monitoring, it enables precise governance in disaster response, environmental protection, and urban planning. Drones aided 2022 Luding earthquake relief with imaging and communication, boosting efficiency. They also enhance ecological monitoring, urban data collection, and public engagement via digital platforms. This supports smarter, more collaborative governance and national modernization.

3. Practical Obstacles to the High-Quality Development of the Low-Altitude Economy

Despite the rapid development of China's low-altitude economy, it still faces multiple structural constraints on its path toward high-quality development.

(1) Insufficient Institutional Supply.

The current airspace management system faces challenges such as cumbersome approval processes and inadequate hierarchical oversight, hindering the efficiency needed for time-sensitive operations like logistics and emergency response. Civilian flights often experience delays due to multi-layered approvals, while regulations lack differentiated supervision for diverse flight activities. This disconnect is evident in cases like delayed drone deployments during rescue missions. Moreover, unclear inter-governmental coordination limits cross-regional collaboration. Future reforms should shift toward dynamic airspace allocation and more flexible approval mechanisms.

(2) Shortcomings in Core Technologies.

The current airspace management system faces challenges such as cumbersome approval processes and inadequate hierarchical oversight, hindering the efficiency needed for time-sensitive operations like logistics and emergency response. Civilian flights often experience delays due to multi-layered approvals, while regulations lack differentiated supervision for diverse flight activities. This disconnect is evident in cases like delayed drone deployments during rescue missions. Moreover, unclear inter-governmental coordination limits cross-regional collaboration. Future reforms should shift toward dynamic airspace allocation and more flexible approval mechanisms.

(3) Weak Infrastructure.

Infrastructure is underdeveloped, with only about 452 general aviation airports nationwide and uneven distribution. The low-altitude intelligent network covers less than 40% of regions, and eastern coastal areas dominate airport locations, leaving central, western, and remote zones underserved. Fragmented protocols and standards impede system connectivity, while poor ground transport links reduce the efficiency of takeoff and landing sites.

(4) Fragmented Application Scenarios.

Applications are often isolated in single cities or sectors, lacking cross-industry and regional synergy. For instance, low-altitude tourism projects remain event-based without sustained operations. Immature business models and absent standards constrain logistics, agriculture, and urban governance use cases. Most applications—from drone deliveries to environmental monitoring—operate as pilots or short-term projects, failing to integrate into broader systems. Scaling up will require policy and market-driven efforts to build an interconnected ecosystem.

(5) Insufficient Talent Support.

A shortage of skilled professionals—such as pilots, drone operators, and airspace managers—is acute in smaller cities and underdeveloped areas. Training programs often emphasize traditional aviation over emerging fields like eVTOL operation, and certification systems for drone operators are inconsistent. Additionally, interdisciplinary talent for manufacturing, operations, and services is scarce, further challenging industry growth.

4. Optimization Pathways for High-Quality Development of the Low-Altitude Economy

To address the practical obstacles identified above, including insufficient institutional supply, shortcomings in core technologies, weak infrastructure, fragmented application scenarios, and insufficient talent support, a systematic, comprehensive, and multi-level approach to optimization is essential.

(1) Institutional Innovation: Constructing a Flexible and Efficient Airspace Governance System.

The airspace management model should shift from rigid control to dynamic allocation, establishing a hierarchical and categorized system that divides airspace into controlled, monitored, and reporting classes. Pilot "grid-based" dynamic opening in key regions like the Guangdong–Hong Kong–Macao Greater Bay Area and the Yangtze River Delta can shorten

approval cycles. Legal frameworks, especially for eVTOL certification and drone pilot credit systems, should be accelerated to form a "negative list + credit-based supervision" model. Clearer inter-governmental responsibilities and cross-regional coordination mechanisms are also needed to support industry scale-up.

(2) Technology Breakthrough: Overcoming Key Core Technology Bottlenecks.

Priority should be given to breakthroughs in high-density batteries, autonomous algorithms, and low-altitude navigation. National-level laboratories should focus on solid-state batteries to extend eVTOL range beyond 500 km. Autonomous systems must achieve >99.5% recognition in complex urban environments, while "5G+BeiDou" positioning should reduce errors to <10 cm. Concurrently, core component localization and industry–academia–research integration are essential to build a full innovation chain and secure global competitiveness.

(3) Infrastructure: Solidifying the Operational Foundation for the Low-Altitude Economy.

A nationwide plan is needed to build a "county-airport, township-point" general-aviation network, adding over 500 vertical takeoff/landing sites by 2025. The Low-Altitude Intelligent Network requires unified protocols and standards to enable cross-platform data sharing. Site selection should ensure seamless ground-transport links. Digital infrastructure, such as low-altitude 5G private networks (<50 ms latency), will support unmanned operations. Together, "hard facilities + soft networks" will form a robust, interconnected low-altitude infrastructure system.

(4) Scenario Expansion: Building a Diverse Application Ecosystem.

Applications should evolve from pilots to integrated ecosystems spanning logistics, tourism, agriculture, emergency response, and urban governance. A "trunk-line large drones + feeder-line small drones" model can cut remote-area logistics costs by >40%. Low-altitude tourism projects can boost local consumption by >20%. Agriculture should link plant-protection drones with precision-farming platforms, while urban governance can adopt regular low-altitude patrols. Policy and market tools should foster sustainable business models and cross-sector synergy.

(5) Talent Development: Improving the Multi-level Talent Support System.

A "academic education + vocational training + skills certification" system is required. Universities should launch relevant majors; enterprises and vocational schools should jointly run training bases. Certification must be standardized. In less-developed regions, flexible mechanisms can attract high-end talent, and inter-regional talent-sharing should be encouraged to ensure human-resource balance.

(6) Collaborative Governance: Enhancing the Modernization of Low-Altitude Economy Governance.

A permanent cross-departmental platform (transport, civil aviation, industry, emergency, public security) should coordinate policies and resources. For flights in sensitive or ecologically valuable areas, community representatives should join risk assessments. Market-oriented mechanisms—such as airspace-rights trading and cultural-resource equity—can spur private investment. A monitoring and evaluation system that includes economic, social, and ecological indicators will guide scientific policymaking, aligning development with broader public benefits.

5. Conclusion

As a globally strategic emerging industry, the low-altitude economy is reshaping the world's economic geography and industrial chains. Its high-quality development is crucial for fostering new quality productive forces, advancing regional coordination, and modernizing governance. Progress requires coordinated efforts in institutions, technology, applications, infrastructure, talent, and collaborative governance. By establishing flexible airspace management, achieving technological breakthroughs, diversifying applications, strengthening infrastructure, improving talent systems, and refining governance, China can build a world-leading low-altitude economy. This will provide strong momentum for new quality productive forces and drive high-quality socio-economic growth.

Acknowledgments

This research is supported by the Guangdong Neusoft University Project "Research on the High-Quality Development Path of the Low-altitude Economy" (Grant No. 2025DRXJ014).

Author Contributions

The entire paper was completed by Lingling Zhao.

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