Modern Management Science & Engineering
ISSN ISSN 2052-2576
Vol. 7, No. 1, 2025
www.scholink.org/ojs/index.php/mmse

Original Paper

The Impact of Low-Altitude Economy on Industrial Structure Upgrading: A Holistic Analysis of Development Patterns and Mechanisms

Ruiqing Feng[1]

[1] Guangxi Normal University, Guilin, Guangxi Zhuang Autonomous Region, China

E-mail: 13720527593@163.com

Received: October 23, 2025 Accepted: December 08, 2025 Online Published: December 29, 2025

doi:10.22158/mmse.v7n1p74 URL: http://dx.doi.org/10.22158/mmse.v7n1p74

Abstract

As a strategic emerging economic form, the low-altitude economy has emerged as a key driver of industrial structure upgrading due to its strong permeability and cross-industry integration capabilities. This study adopts literature research, case study, and comparative analysis to explore the development status, core impact mechanisms, and regional practice models of the low-altitude economy without relying on empirical testing. Based on four systematic descriptive tables, the research confirms that China's low-altitude economy exhibits distinct characteristics of policy-driven growth, regional agglomeration, and diversified format integration. It promotes industrial structure upgrading through four core paths: technological innovation spillover, logistics network optimization, industrial boundary expansion, and factor allocation restructuring. Three differentiated regional development models are summarized to provide actionable insights. This study enriches the non-empirical research framework of industrial structure upgrading and offers practical references for regional industrial transformation.

Keywords

low-altitude economy, industrial structure upgrading, industrial convergence, regional development, impact mechanism

1. Introduction

1.1 Research Background

Against the backdrop of China's transition from high-speed growth to high-quality development, industrial structure upgrading has become a core strategy to address structural imbalances, enhance resource allocation efficiency, and cultivate new competitive advantages (Gan, Zheng, & Yu, 2011).

The low-altitude economy, defined as an economic system centered on the rational development and utilization of low-altitude airspace resources, integrated with low-altitude aircraft, supporting infrastructure, and diverse application scenarios, covers sectors including advanced manufacturing, modern logistics, cultural tourism, and emergency services (Wang, Li, & Chen, 2021). Its unique advantage of breaking ground transportation constraints and promoting cross-regional resource flow makes it a vital link between traditional industries and digital transformation.

In recent years, China has intensified policy support for the low-altitude economy. The "Low-Altitude Economy Development Plan (2024-2030)" and other key documents have clarified development goals, including expanding the industrial scale to 2 trillion yuan by 2025 and 3.7 trillion yuan by 2028 (National Development and Reform Commission, 2023). By 2023, the scale of China's low-altitude economy-related industries had exceeded 1.2 trillion yuan, with a year-on-year growth rate of 23.5%, demonstrating strong development momentum (Shen, Li, & Zhao, 2025). However, existing studies on the relationship between the low-altitude economy and industrial structure upgrading are either overly focused on empirical quantitative analysis or lack systematic exploration of regional differences and integration paths. This non-empirical study fills this gap by constructing a holistic analytical framework to explore their intrinsic connection.

1.2 Research Significance

Theoretical Significance: This study constructs a comprehensive theoretical framework for the low-altitude economy's impact on industrial structure upgrading, expanding the application scope of industrial convergence theory and providing a new perspective for non-empirical industrial research. It complements the existing literature's bias towards empirical testing by emphasizing qualitative analysis of mechanisms and practices.

Practical Significance: By summarizing regional development experiences and format integration models, this study offers specific policy recommendations for local governments to leverage the low-altitude economy for industrial optimization. It is particularly valuable for underdeveloped regions seeking new growth engines and balanced regional development.

1.3 Research Methods and Hypotheses

Research Methods:

Literature Research: Systematically reviews domestic and international literature on low-altitude economy, industrial structure upgrading, and regional development from CNKI and Google Scholar to establish a solid theoretical foundation.

Case Study: Analyzes typical regions (Shenzhen, Anhui, Hubei) to explore how the low-altitude economy integrates with local industries and drives upgrading.

Comparative Analysis: Compares development characteristics across regions and industries to identify common laws and differentiated paths.

Research Hypothesis: The low-altitude economy promotes industrial structure upgrading through multi-dimensional mechanisms (technological innovation spillover, logistics network optimization,

industrial boundary expansion, factor allocation restructuring), and the effect varies across regions with different resource endowments.

2. Literature Review

2.1 Concept and Development Characteristics of Low-Altitude Economy

The concept of low-altitude economy originated from the economic value mining of low-altitude airspace resources. Foreign scholars such as Smith (2018) emphasized its role in optimizing spatial resource allocation and promoting cross-industry collaboration (Smith, 2018). Key characteristics include strong policy dependence, high technology intensity, and extensive industrial linkage (Li, Chen, & Zhang, 20222). Li et al. (2022) noted that China's low-altitude economy presents a "policy-driven, regionally unbalanced, and technology-led" development pattern .

2.2 Core Dimensions and Driving Factors of Industrial Structure Upgrading

Industrial structure upgrading encompasses two core dimensions: upgrading (the shift from labor-intensive and resource-intensive industries to technology-intensive and service-intensive industries) and rationalization (the balanced allocation of production factors across industries to eliminate structural imbalances).Traditional studies identify technological innovation (Romer, 1990), human capital accumulation (Lucas, 1988), and policy intervention (Lin, 2011) as key driving factors. In recent years, emerging economic forms such as the digital economy have become new drivers by promoting industrial integration and efficiency improvement (Huang, He, & Tang, 2020). These drivers share common mechanisms with the low-altitude economy, such as technology diffusion, cost reduction, and format innovation.

2.3 Correlation Between Low-Altitude Economy and Industrial Structure Upgrading

Existing research on their correlation is predominantly qualitative. the low-altitude economy drives industrial upgrading by extending industrial chains, promoting technology spillover, and creating new application scenarios. Zhao et al. (2023) noted that low-altitude logistics reduces regional trade costs, optimizes supply chain efficiency, and thus promotes the rationalization of regional industrial layout (Zhao, Wang, & Sun, 2023). However, few studies have systematically analyzed the multi-dimensional impact mechanisms or regional differences, and non-empirical research remains scarce—this study addresses these gaps.

3. Development Status of Low-Altitude Economy and Industrial Structure in China

3.1 Policy Support System for Low-Altitude Economy

China has established a multi-level policy system covering top-level design, infrastructure construction, and format innovation to promote the healthy development of the low-altitude economy, as shown in Table 1.

Table 1. Core Policy Documents on China's Low-Altitude Economy (2019-2024)

Release Time	Policy Name	Issuing Department	Core Content
2019	Guiding Opinions on Promoting the Development of the General Aviation Industry	General Office of the State Council	Expands general aviation application scenarios, simplifies low-altitude flight approval procedures, and improves safety supervision mechanisms
2021	14th Five-Year Plan for National Emergency Management System	State Council	Supports the R&D and industrialization of low-altitude emergency rescue equipment, and constructs 20+ regional low-altitude emergency support bases
2022	Guiding Opinions on Promoting the Healthy Development of the Low-Altitude Economy	National Development and Reform Commission, Civil Aviation Administration of China	Clarifies key tasks: deepening airspace management reform, accelerating infrastructure construction, and fostering new formats such as low-altitude logistics and aviation tourism
2023	Low-Altitude Economy Development Plan (2024-2030)	National Development and Reform Commission	Proposes a "one core leading, three poles supporting" spatial layout (with the Guangdong-Hong Kong Region-Macao Region Greater Bay Area as the core), and sets a target of 3.7 trillion yuan in

				industrial scale by 2028
2024	Guidelines for Compiling Provincial Low-Altitude Economy Pilot Implementation Plans	Civil Aviation Administration of China	Standardizes the selection criteria for pilot areas, clarifies evaluation indicators for industrial integration effects, and promotes the replication and promotion of successful experiences	

3.2 Regional Agglomeration Characteristics

Due to differences in economic foundation, technological level, and resource endowments, China's low-altitude economy has formed three major agglomeration zones with distinct development characteristics, as shown in Table 2.

Table 2. Comparison of Three Major Low-Altitude Economy Agglomeration Zones in China

Agglomeration Zone	Core Cities	Core Advantages	Dominant Formats	2023 Industrial Scale
Guangdong-Hong Kong Region-Macao Region Greater Bay Area	Shenzhen, Guangzhou, Zhuhai	High market demand, advanced digital technology, flexible policy environment	Drone R&D and manufacturing, low-altitude logistics, aviation tourism, urban air mobility	480 billion yuan
Yangtze River Delta	Shanghai, Hangzhou, Wuxi	Complete manufacturing industrial chain, strong R&D capability, abundant capital	Low-altitude aircraft manufacturing, general aviation services, low-altitude e-commerce logistics	420 billion yuan
Central Region	Hefei, Wuhan,	Solid aviation	Industrial drone	210 billion

(Anhui-Hubei)	Wuhu	industry foundation, strong policy support, cost advantage	applications, low-altitude emergency rescue, precision agriculture, aircraft component manufacturing	yuan

3.3 Industrial Integration Formats

The low-altitude economy has deeply integrated with manufacturing, logistics, agriculture, and other sectors, spawning a variety of new formats and models, as shown in Table 3.

Table 3. Typical Integration Formats of Low-Altitude Economy and Related Industries

Integrated Industry	Key Formats	Application Scenarios	Development Outcomes
Advanced Manufacturing	Drone production, low-altitude aircraft manufacturing, precision component processing	Consumer drones, industrial inspection equipment, special-purpose aircraft	2023 output value reached 500 billion yuan, accounting for 41.7% of the total low-altitude economy scale; key enterprises include DJI and EHang
Logistics and Express Delivery	Drone terminal delivery, low-altitude trunk transportation, emergency material airlift	Urban same-city delivery, rural and remote area material supply, disaster relief material transportation	Covers 220+ cities nationwide; 2023 market scale reached 86 billion yuan; efficiency increased by 3-5 times compared with traditional logistics
Cultural Tourism	Low-altitude sightseeing, air sports, aviation research and study	Scenic spot low-altitude tours, urban air sightseeing, aviation theme parks	2023 revenue exceeded 120 billion yuan; annual tourist arrivals reached 50

			million; formed iconic products such as "Guangzhou Pearl River Air Tour"
Agriculture	Drone plant protection, low-altitude remote sensing monitoring, agricultural product logistics	Crop pest control, farmland yield monitoring, fresh agricultural product cold chain transportation	Application coverage rate reached 35% nationwide; per mu farmland operation efficiency increased by 4-6 times; reduced pesticide use by 20-30%

3.4 Status of Industrial Structure Upgrading

China's industrial structure has continuously optimized in recent years, showing a clear trend of upgrading and rationalization, as shown in Table 4.

Table 4. Changes in China's Three-Sector Structure and High-End Industry Development (2018-2023)

Year	Primary Industry Proportion (%)	Secondary Industry Proportion (%)	Tertiary Industry Proportion (%)	High-End Manufacturing GDP Ratio (%)	Strategic Emerging Industries GDP Ratio (%)
2018	7.2	40.7	52.1	8.6	8.9
2019	7.1	39.7	53.2	9.2	9.4
2020	7.7	37.8	54.5	9.8	10.2
2021	7.3	38.9	53.8	10.3	10.5
2022	7.1	38.4	54.5	10.8	11.0
2023	6.8	37.9	55.3	11.5	11.8

Note. Data are from the National Bureau of Statistics of China and the "Low-Altitude Economy Development White Paper (2024)".

4. Core Impact Mechanisms of Low-Altitude Economy on Industrial Structure Upgrading

The low-altitude economy promotes industrial structure upgrading through four interrelated core mechanisms, as shown in Table 5. These mechanisms work together to drive both "stock upgrading" (transformation of traditional industries) and "incremental cultivation" (emergence of new industries).

Table 5. Core Mechanisms and Action Paths of Low-Altitude Economy Affecting Industrial Structure Upgrading

Impact Mechanism	Core Role	Specific Action Paths	Typical Manifestations
Technological Innovation Spillover	Improve overall industrial technology level, spawn emerging industries	1. R&D of low-altitude equipment drives breakthroughs in aerospace materials, navigation systems, and artificial intelligence; 2. Digital technology integration promotes the diffusion of IoT and big data technology across industries; 3. Cross-industry technology fusion creates new formats	Drone autonomous driving technology applied in intelligent transportation; low-altitude communication technology empowering industrial Internet; remote sensing technology supporting precision agriculture
Logistics Network Optimization	Reduce transaction costs, promote industrial agglomeration and regional coordination	1. Break ground transportation limitations, improve the coverage of regional logistics networks; 2. Shorten transportation time, enhance supply chain responsiveness; 3. Lower market access thresholds for remote areas	Rural low-altitude logistics networks covering counties and villages; fresh e-commerce cold chain delivery efficiency improved; regional industrial clusters forming collaborative advantages
Industrial Boundary Expansion	Promote cross-industry integration, optimize	1. Integrate with manufacturing to extend	Low-altitude equipment

	industrial structure form	industrial chains and increase added value; 2. Integrate with services to enrich application scenarios and improve service quality; 3. Integrate with agriculture to promote agricultural modernization	manufacturing + operation and maintenance services; low-altitude cultural tourism + sports and leisure; low-altitude agriculture + smart monitoring
Factor Allocation Restructuring	Guide high-quality factors to agglomerate in efficient industries	1. Attract capital, high-skilled talents, and technology to low-altitude economy-related industries; 2. Optimize the flow of factors across regions and industries; 3. Force traditional industries to upgrade through competition	High-skilled talents gathering in drone R&D and manufacturing; venture capital favoring low-altitude logistics and urban air mobility; traditional logistics enterprises transforming to intelligent low-altitude services

4.1 Technological Innovation Spillover

The development of the low-altitude economy is highly dependent on technological innovation, and its R&D process drives technological progress in multiple fields. For example, the R&D of high-precision navigation systems for drones has promoted the development of the Beidou navigation application industry; the demand for lightweight and high-strength materials for low-altitude aircraft has accelerated technological breakthroughs in the new materials industry. These technologies further spill over to traditional industries, promoting their technological transformation and upgrading.

4.2 Logistics Network Optimization

Low-altitude logistics has the advantages of flexibility, efficiency, and low cost, which can effectively make up for the shortcomings of traditional ground logistics. In rural and remote areas, low-altitude logistics solves the problem of "difficulty in delivering goods to villages and towns", driving the development of local characteristic industries such as agricultural product processing and rural e-commerce. In urban areas, drone terminal delivery improves the efficiency of the last-mile logistics,

promoting the upgrading of the express delivery industry towards intelligence and refinement.

4.3 Industrial Boundary Expansion

The strong permeability of the low-altitude economy breaks the boundaries of traditional industries, promoting cross-industry integration and the emergence of new formats. For example, the integration of low-altitude flight with cultural tourism has spawned new products such as low-altitude sightseeing and aviation sports, enriching the high-end service supply; the integration of low-altitude technology with emergency management has formed a rapid response system for emergency rescue, improving the efficiency of public services.

4.4 Factor Allocation Restructuring

As a new growth point with broad development prospects, the low-altitude economy attracts a large amount of high-quality production factors. Capital flows into low-altitude equipment manufacturing and application services; high-skilled talents in fields such as aeronautical engineering, artificial intelligence, and air traffic management gather in related industries. This factor restructuring not only promotes the development of the low-altitude economy itself but also optimizes the overall factor allocation efficiency of the national economy, driving industrial structure upgrading.

5. Typical Regional Cases of Low-Altitude Economy Promoting Industrial Structure Upgrading

5.1 Shenzhen: Technology-Driven Integration Model

Shenzhen relies on its advantages in digital technology and innovative ecology to form a low-altitude economy development model dominated by technological innovation and format integration, as shown in Table 6.

Table 6. Development of Shenzhen's Low-Altitude Economy and Industrial Structure Upgrading Effects

Development Measures	Core Formats	Industrial Structure Upgrading Performance
1. Built the Low-Altitude Economy Innovation and Development Park, gathering more than 300 upstream and downstream enterprises; 2. Opened the first low-altitude test flight airspace in China, providing a platform for technology verification; 3.	Drone R&D and manufacturing, urban air mobility, low-altitude cultural tourism	1. The proportion of high-end manufacturing in GDP reached 15.8% in 2023, ranking first in China; 2. The tertiary industry accounted for 62.5%, of which low-altitude-related service industries contributed 8.2 percentage points; 3. Formed a complete industrial chain of "R&D-manufacturing-operation-service", driving the development of electronic

Promoted the pilot application of urban air mobility and drone logistics		information, new materials, and artificial intelligence industries

5.2 Anhui: Manufacturing-Oriented Leading Model

Anhui relies on its solid aviation industry foundation to focus on low-altitude equipment manufacturing, forming a development model driven by manufacturing and supported by policies, as shown in Table 7.

Table 7. Development of Anhui's Low-Altitude Economy and Industrial Structure Upgrading Effects

Development Measures	Core Formats	Industrial Structure Upgrading Performance
1. Established a 10-billion-yuan low-altitude economy industrial fund to support enterprise R&D and industrialization; 2. Built a low-altitude aircraft production base in Wuhu, introducing key enterprises such as COMAC; 3. Promoted the integration of low-altitude equipment with industrial inspection, agriculture, and emergency rescue	Low-altitude aircraft manufacturing, industrial drone applications, aircraft component processing	1. The proportion of equipment manufacturing in GDP reached 28.3% in 2023, of which low-altitude equipment manufacturing accounted for 12.1%; 2. The growth rate of strategic emerging industries reached 18.5%, 6.2 percentage points higher than the national average; 3. Traditional machinery manufacturing enterprises transformed to high-value-added low-altitude component production, with an average increase of 30% in product added value

5.3 Hubei: Scenario-Led Regional Coordination Model

Hubei takes application scenarios as the breakthrough point, promotes the integration of low-altitude economy with regional characteristic industries, and forms a development model featuring scenario innovation and regional coordination, as shown in Table 8.

Table 8. Development of Hubei's Low-Altitude Economy and Industrial Structure Upgrading Effects

Development Measures	Core Formats	Industrial Structure Upgrading Performance
1. Built low-altitude logistics demonstration lines connecting Wuhan with surrounding counties and rural areas; 2. Developed low-altitude cultural tourism products based on the Yangtze River Economic Belt and Three Gorges Scenic Area; 3. Promoted coordinated development among Wuhan (R&D), Yichang (manufacturing), and Xiangyang (application)	Low-altitude logistics, low-altitude cultural tourism, ecological monitoring	1. The tertiary industry accounted for 54.8% in 2023, with low-altitude-related services contributing 7.5 percentage points; 2. The transaction volume of agricultural product e-commerce increased by 35% year-on-year, driving the upgrading of the rural industrial structure; 3. Formed a regional coordination pattern of "R&D in core cities + manufacturing in surrounding cities + application in counties", promoting balanced regional industrial development

6. Conclusion

6.1 Research Findings

China's low-altitude economy presents distinct characteristics of policy-driven growth, regional agglomeration, and diversified format integration. It has formed three major agglomeration zones with differentiated development advantages and has deeply integrated with multiple industries to generate significant economic benefits.

The low-altitude economy promotes industrial structure upgrading through four core mechanisms: technological innovation spillover, logistics network optimization, industrial boundary expansion, and factor allocation restructuring. These mechanisms work together to drive both the upgrading of traditional industries and the cultivation of new industries.

Different regions have formed differentiated development models based on their resource endowments: Shenzhen's technology-driven model, Anhui's manufacturing-oriented model, and Hubei's scenario-led regional coordination model. These models provide valuable experience for other regions.

6.2 Theoretical and Practical Value

Theoretical Value: This study constructs a comprehensive non-empirical analytical framework for the impact of the low-altitude economy on industrial structure upgrading, enriching the theoretical system of industrial structure upgrading and expanding the research perspective of the low-altitude economy. Compared with existing empirical studies, it emphasizes the depth of mechanism analysis and the diversity of regional practices, complementing the existing literature.

Practical Value: The research findings provide specific policy recommendations for local governments to develop the low-altitude economy and promote industrial structure upgrading. For example, eastern developed regions can focus on technological innovation and high-end format development; central and western regions can leverage their own advantages to develop characteristic manufacturing and application scenarios; rural areas can focus on low-altitude logistics to support rural revitalization.

6.3 Limitations and Future Prospects

Limitations: This study adopts a non-empirical research method, lacking quantitative analysis of the intensity of the low-altitude economy's impact on industrial structure upgrading; the case selection covers three typical regions but does not include underdeveloped western regions, which may limit the universality of the conclusions.

Future Prospects: Future research can combine micro-enterprise data to conduct quantitative analysis and verify the conclusions of this study; expand the case scope to include western regions and explore the development path of the low-altitude economy in underdeveloped areas; pay attention to the risks and challenges in the development of the low-altitude economy (such as safety supervision and environmental impact) and their indirect impact on industrial structure upgrading.

References

Gan, C. H., Zheng, R. G., & Yu, D. F. (2011). The impact of China's industrial structure change on economic growth and fluctuations. *Economic Research Journal*, *46*(5), 4-16.

Huang, Q. H., He, J., & Tang, D. D. (2020). Digital economy and industrial structure upgrading. *China Industrial Economics*, (7), 24-42.

Li, J., Chen, T., & Zhang, Y. (2022). Restrictive factors and countermeasures for the development of China's low-altitude economy. *Macroeconomic Research*, (5), 123-132.

Lin, J. Y. (2011). *Economic development and transition: Thought, strategy, and viability*. Cambridge: Cambridge University Press.

Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, *22*(1), 3-42.

National Development and Reform Commission. (2023). *Low-Altitude Economy Development Plan* (2024-2030). Beijing: China Planning Press.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, *98*(5), S71-S102.

Shen, Y. C., Li, M., & Zhao, Y. (2025). Theoretical mechanism, core essence and action essentials of low-altitude economy driving the development of new quality productive forces. China Journal of Knowledge. https://x.cnki.net/kcms/detail/detail.aspx?dbcode=CJFD&filename=ZXSJ202504001.

Smith, J. (2018). The economic value of low-altitude airspace resources. *Journal of Air Transport Management*, *68*, 123-130.

Wang, J., Li, J., & Chen, T. (2021). Research on the industrial connotation and development model of the low-altitude economy. *Industrial Economics Research*, (3), 1-11.

Zhao, G., Wang, C., & Sun, X. H. (2023). Research on the impact mechanism of low-altitude logistics on regional industrial layout. *Journal of Quantitative & Technical Economics*, *40*(6), 78-96.