Research on Low-Altitude Logistics Infrastructure Planning and Collaborative Governance under the Background of the Western Land-Sea New Channel

Shenggang Gong*
School of Business Administration, Baise University, Baise, Guangxi, China
**Corresponding Author*

Abstract: Under the dual circumstances of the country's vigorous promotion of the construction of the Western Land-Sea New Passage and the vigorous development of the low-altitude economy, the integration of low-altitude logistics and the Western Land-Sea New Passage is becoming a new research hotspot. This article focuses on the practical pain points of traditional logistics "last mile" delivery in complex terrains such as mountains, hills, coasts, and islands along the passage. Based on infrastructure planning theory and collaborative governance theory, it systematically explains the deep coupling mechanism of low-altitude logistics and the Western Land-Sea New Passage in terms of functional complementarity, spatial connection, and operational collaboration. It also analyzes the current practical bottlenecks faced by low-altitude logistics infrastructure construction, such as fragmented planning, airspace constraints, inconsistent standards, insufficient regional collaboration, and lack of funds. The study proposes to build a multi-level low-altitude logistics network system of "core hub - regional node - terminal facility", and form a collaborative governance path from five dimensions: top-level design, institutional mechanisms, facility construction, policy support, and implementation guarantee. This provides theoretical support and practical references for building an efficient and coordinated comprehensive logistics system along the passage, and helps to implement the regional coordinated development and the strategy of building a transportation-strong country.

Keywords: Western Land-Sea New Passage; Low-Altitude Economy; Low-Altitude Logistics; Infrastructure Planning; Collaborative Governance

1. Introduction

As a major national strategic project, the Western Land-Sea New Channel is accelerating the reshaping of the opening-up pattern in southwestern China. Currently, the main construction of the Pinglu Canal, the backbone project of the channel, has been fully completed. It is expected to be put into operation for navigation in September 2026. The container throughput of the Beibu Gulf Port has exceeded 9 million TEUs, and the annual number of sea-rail intermodal trains has exceeded 10,000. The total mileage of the integrated and multi-modal transportation network in Guangxi, including land, sea, air and digital transportation, has exceeded 190,000 kilometers [1]. At the same time, the low-altitude economy has been upgraded to a national emerging pillar industry, carrying the core mission of cultivating new productive forces. The national plan clearly states that by 2030, a unified low-altitude operation management service platform will be built across the country, and more than 3,000 take-off and landing nodes will be laid out [2].

Against this macro backdrop, the integrated development of China's low-altitude logistics and the New Western Land-Sea Corridor has become an inevitable trend. The corridor covers complex terrains such as mountains, hills, coasts, and islands, and traditional logistics face severe challenges in "last-mile" delivery, mountain transportation, and island supply [3]. Low-altitude logistics, with its point-to-point rapid delivery advantages, can effectively break through geographical limitations and provide a new solution to address these pain points. Based on this, this paper systematically explores the theoretical basis for low-altitude logistics infrastructure planning under the context of the Western Land-Sea New Corridor, the collaborative mechanism with existing logistics channels, the practical challenges faced, and the

construction of collaborative governance mechanisms. The aim is to expand the regional analysis dimension of low-altitude logistics, deepen the spatio-temporal theory of infrastructure planning, and provide theoretical support and policy references for building an efficient and collaborative regional integrated logistics system, thereby contributing to the realization of the strategies of a transportation-strong country and regional coordination.

2. Core Concept Definition and Theoretical Basis

2.1 Concept Connotation of Low-Altitude Logistics

Low-altitude logistics refers to the cargo transportation and delivery services carried out through low-altitude aviation activities, using low-altitude aircraft such as unmanned aerial vehicles (UAV) and electric vertical take-off and landing aircraft (eVTOL) [4]. It is a specific application form of low-altitude economy in the field of logistics. From the perspective of concept evolution, low-altitude logistics has undergone a theoretical advancement process from "unmanned aerial vehicle delivery" to "low-altitude logistics". Early research mainly focused on the technical performance and commercial application scenarios of unmanned aerial vehicles, emphasizing their role in improving the efficiency of end-point delivery [5]. In recent years, with the enhancement of the strategic positioning of low-altitude economy and the expansion of its industrial scale, the connotation of low-altitude logistics has continuously enriched, covering various application scenarios such as trunk and branch logistics connection, island material supply, mountainous area cargo transportation, and emergency material delivery, forming a comprehensive logistics form that complements ground logistics, waterway logistics, and air logistics [6].

2.2 Theoretical Basis

The infrastructure planning theory provides important theoretical support for understanding low-altitude logistics infrastructure planning. This article mainly explores the theoretical basis of infrastructure planning from three dimensions: spatial layout theory, network form theory, and system synergy theory. In terms of spatial layout theory, the spatial layout of infrastructure needs to follow certain spatial economic laws. The center-city theory emphasizes that the layout of infrastructure should consider the service area and hierarchical structure; the growth pole theory emphasizes that priority should be given to developing core nodes with leading effects; the point-axis system theory emphasizes linear layout along important transportation axes [7]. In terms of network form theory, infrastructure is formed into a network system through connections. The transportation network theory holds that the network structure determines the service capacity of infrastructure; the complex network theory provides a theoretical tool for understanding the evolution laws of logistics infrastructure networks [8]. In terms of system synergy theory, infrastructure planning needs to consider the synergy relationship between different types of facilities. The comprehensive transportation theory emphasizes the organic connection and coordination of different transportation modes such as roads, railways, waterways, and aviation; the multimodal transport theory further emphasizes achieving seamless connection across modes through standardized transportation units, information sharing, and "one-ticket" operation [9].

The collaborative governance theory provides an important theoretical framework for understanding the cross-regional and cross-departmental collaborative governance of low-altitude logistics infrastructure. The collaborative governance theory emphasizes that in the governance of complex public affairs, it is necessary to achieve an overall improvement in governance efficiency through the collaborative cooperation of multiple entities [10]. From the perspective of collaborative entities, the collaborative governance of low-altitude logistics infrastructure involves multiple entities such as the government, enterprises, social organizations, and the public. From the perspective of collaborative content, the collaborative governance of low-altitude logistics infrastructure includes multiple aspects such as planning collaboration, construction collaboration, operation collaboration, and regulatory collaboration. From the perspective of collaborative mechanisms, the realization of collaborative governance requires the establishment of effective coordination mechanisms, interest coordination mechanisms,

and information sharing mechanisms [11].

3. The Inner Mechanism of Low-altitude logistics integrates into the construction of the Western Land-Sea New Passage

3.1 Planning Foundation

The Western Land-Sea New Corridor provides a solid strategic support and development demand foundation for the planning of low-altitude logistics infrastructure. From the perspective of strategic support, the Western Land-Sea New Corridor is an important component of the national "Belt and Road" initiative and the major regional coordinated development strategy, and has been elevated to a national strategy. The Grand Canal serves as the backbone project of the Western Land-Sea New Corridor, providing a vast hinterland market and application scenarios for the development of low-altitude logistics [12]. From the perspective of development demand, the logistics demands along the Western Land-Sea New Corridor show a diversified characteristic, creating space for the development of low-altitude logistics. Low-altitude logistics can break through geographical limitations and achieve rapid point-to-point delivery, providing new possibilities for addressing the challenges of traditional logistics. On the other hand, the industrial layout along the corridor is accelerating optimization, and the Grand Canal Economic Belt is being constructed, initially forming characteristic industrial clusters such as new energy, green chemicals, and advanced equipment manufacturing [13]. These industrial developments have higher requirements for the timeliness and flexibility of logistics services, creating demand space for the application of low-altitude logistics.

3.2 Layout Principles

The spatial layout of low-altitude logistics infrastructure for the Western Land-Sea New Corridor needs to follow certain theoretical principles and practical orientations. First, the demand-oriented principle. The spatial layout should be guided by logistics demands, and facilities should be scientifically and reasonably located in accordance with the industrial development, urban distribution, and population concentration characteristics along the corridor [14]. Second, the hierarchical progressive principle. The spatial layout should follow the point-axis system theory and form a multi-level layout structure of "core hub - regional node - terminal facilities" [7]. Third, the collaborative linkage principle. The spatial layout should form a collaborative linkage with existing logistics infrastructure such as highways, railways, waterways, and aviation, and jointly constitute a comprehensive logistics system [11]. Fourth, the local adaptation principle. The spatial layout should fully consider the geographical conditions and environmental characteristics along the Western Land-Sea New Corridor, and achieve differentiated layout [15].

3.3 Synergistic Mechanism

The low-altitude logistics infrastructure is deeply coupled with the Western Land-Sea New Passage system, manifested in three dimensions: functional complementarity, spatial connection, and operational synergy. Firstly, low-altitude logistics, leveraging its advantages of breaking geographical restrictions and providing point-to-point delivery, complements the functions of roads, railways, waterways, and traditional aviation, jointly constructing a complete integrated logistics system [13]. Secondly, low-altitude logistics facilities should be closely connected with existing hubs [16]. At ports, they can serve as port extension facilities; at railway stations, they can solve the "last mile" delivery problem; at road freight stations, they can form public-air transport integration; at air freight stations, they can achieve ground connection, thus deeply integrating into the comprehensive logistics network. Thirdly, it is necessary to collaborate in terms of transportation capacity, information, and standards [16]. In terms of transportation capacity, it serves as a supplement during peak periods and in special scenarios; in terms of information, it realizes interconnection with various logistics systems to ensure full-process visualization; in terms of standards, it unifies the waybill, data interface, and service norms to reduce system integration costs.

4. The Current Situation and Challenges of Low-altitude Logistics Infrastructure Construction

4.1 Status of Construction

Multi-site exploration and initial development.

In recent years, many regions in China have been actively exploring the construction of low-altitude logistics infrastructure, presenting a multi-point development and step-by-step advancement trend. At the national level, the "National Low-Flying Economy Development Plan Outline (2026-2030)" clearly states that by 2030, a unified national low-altitude operation management service platform will be established, with more than 3,000 take-off and landing parking points distributed, and low-altitude communication and navigation coverage will be achieved in key areas. This top-level design provides policy guidance and development goals for local low-altitude logistics infrastructure construction. At the local level, several provinces have issued relevant policy documents for low-altitude logistics infrastructure construction, providing useful references for the construction of low-altitude logistics infrastructure in the Western Land-Sea New Passage [17].

4.2 Challenges

The planning system is not complete. Currently, the provinces and regions along the Western Land-Sea New Passage have been operating independently in the planning of low-altitude logistics infrastructure, lacking regional-level coordination. The absence of a planning system leads to the problems of blindness and fragmentation in the construction of low-altitude logistics infrastructure, making it difficult to achieve scale and network effects [18].

The restrictions on airspace management are strict. Low-altitude airspace is the basic resource for the development of low-altitude logistics, but the current reform of airspace management system is still in the process of implementation, and the use of airspace resources is subject to relatively strict restrictions. Before the complete implementation of airspace management reform, low-altitude logistics flight activities face problems such as complex approval procedures and long time-consuming flight plan approval, which affects the commercial operation of low-altitude logistics [19].

The technical standards are not unified. The construction of low-altitude logistics infrastructure involves multiple fields such as unmanned aircraft technology, communication technology, and navigation technology, but the current relevant technical standards and norms are not yet complete[17,20]. Different manufacturers' unmanned aircraft have differences in interface protocols, data formats, etc., affecting the interconnection of equipment. The construction standards, safety standards, service standards, etc. of take-off and landing facilities also need to be unified.

Regional collaboration is insufficient. The Western Land-Sea New Passage involves multiple provinces and cities such as Chongqing, Sichuan, Guizhou, Yunnan, and Guangxi, and the construction of low-altitude logistics infrastructure requires regional-level coordination [21]. However, the current regional collaboration mechanism is not yet complete, and there are differences in policy support, construction standards, and operation rules among different regions, making it difficult to form a regional integrated low-altitude logistics service network. The approval procedures for cross-provincial low-altitude logistics flight activities are complex and the coordination costs are high, restricting the integrated development of regional low-altitude logistics.

Insufficient capital investment. The construction of low-altitude logistics infrastructure requires a large amount of capital investment, including take-off facility construction, communication and navigation facility construction, and information system construction [22]. However, currently, low-altitude logistics infrastructure construction mainly relies on government fiscal investment, and the enthusiasm of social capital participation is not high. The long investment return period and immature business model affect the entry of social capital. Insufficient capital investment has become an important bottleneck restricting the construction of low-altitude logistics infrastructure.

5. Suggestions

5.1 Improve top-level design

To promote the high-quality development of low-altitude logistics infrastructure for the Western Land-Sea New Passage, the first step is to improve the overall planning. A regional collaborative planning system should be established. First, under the guidance of the national "15th Five-Year Plan" and the low-altitude economic development plan, the Low-

Airport Economic Development Department of the National Development and Reform Commission should take the lead, in collaboration with relevant departments, to formulate the "Low-Airport Logistics Development Plan for the Western Land-Sea New Passage". This plan should clearly define the strategic positioning, development goals, spatial layout, key tasks and guarantee measures of low-altitude logistics in the passage, providing top-level guidance for regional development. Second, establish a regional planning coordination mechanism. The Western Land-Sea New Passage involves multiple provinces and cities such as Chongqing, Sichuan, Guizhou, Yunnan and Guangxi. The low-altitude logistics development plan needs to be coordinated at the regional level. Third, incorporate low-altitude logistics into the relevant planning system, clearly defining the functional positioning of low-altitude logistics in the comprehensive logistics system. At the same time, the low-altitude logistics infrastructure planning should be coordinated and connected with land use planning, urban master planning, transportation planning, etc., to ensure the availability of construction land and spatial guarantees for the projects.

5.2 Innovate Institutional Mechanisms

To promote the high-quality development of low-altitude logistics infrastructure along the Western Land-Sea New Passage, it is necessary to innovate institutional mechanisms and establish an efficient and collaborative governance mechanism. First, it is suggested to establish a cross-regional collaborative promotion mechanism. Considering the cross-provincial characteristics of the Western Land-Sea New Passage, it is recommended to establish a "national - provincial - municipal" three-level linkage cross-regional collaborative promotion mechanism. Second, it is suggested to innovate a cross-departmental collaborative supervision mechanism. Low-altitude logistics involves supervision by multiple departments, and integrating the forces of development reform, transportation, aviation, and emergency management departments, a supervision model combining "comprehensive supervision + specialized supervision" is proposed. Third, a pilot demonstration mechanism should be established. Pilot demonstration zones for low-altitude logistics should be set up in core areas such as the Beibu Gulf Port and the Pinglu Canal, conducting pioneering and leading trials in low-altitude logistics infrastructure construction, operation services, and technical standards, and through pilot demonstrations, accumulating experience before gradually promoting it.

5.3 Accelerate Facility Construction

To promote the high-quality development of low-altitude logistics infrastructure along the Western Land-Sea New Passage, it is necessary to accelerate infrastructure construction and build a networked infrastructure system. First, accelerate the construction of core hub facilities. Core nodes should be prioritized for the layout of low-altitude logistics infrastructure. Second, improve the layout of regional node facilities. Low-altitude logistics regional nodes should be located in regional central cities to undertake functions such as urban distribution, regional transfer, and industrial services. Third, fill the gaps in terminal facilities. Small-sized and simple low-altitude take-off and landing facilities should be laid out in terminal areas such as industrial parks, border ports, islands, and rural areas. Fourth, build a low-altitude communication and navigation network. The 5G-A network should be accelerated to cover the key areas for the development of low-altitude logistics, providing reliable communication guarantees for low-altitude logistics.

5.4 Strengthen Policy Support

To promote the high-quality development of low-altitude logistics infrastructure along the Western Land-Sea New Passage, it is necessary to strengthen policy support and create a favorable development environment. First, increase the support for fiscal funds. The construction of low-altitude logistics infrastructure can be included in the special funds support scope of the Western Land-Sea New Passage, and at the same time, establish a low-altitude logistics development special fund to support research and development, construction, and talent training. Second, innovate financing models. Encourage social capital to participate in the construction and operation of low-altitude logistics infrastructure, and promote government-society cooperation and concession operation models. At the same time, it is suggested that financial institutions

innovate financial products to provide diversified financial services such as leasing and supply chain finance for low-altitude logistics enterprises. Support qualified enterprises to broaden financing channels by issuing bonds, listing, and other means. Third, improve land guarantee policies. It is suggested that low-altitude logistics infrastructure land be included in the annual land use plan to ensure the project's land demand. For low-altitude logistics projects that comply with the plan, priority should be given to allocating additional land use indicators. At the same time, it is necessary to explore the model of comprehensive development of low-altitude logistics facilities and transportation stations, warehouses, etc., to improve land utilization efficiency. Fourth, strengthen talent cultivation and introduction. It is suggested to support universities in Guangxi to establish low-altitude economy-related majors to cultivate low-altitude logistics professional talents. Encourage enterprises to conduct drone pilot training to enhance the skills of practitioners. At the same time, it is necessary to increase the intensity of high-level talent introduction, attracting talents in fields such as drone research, artificial intelligence, and flight control to start businesses and work in the Western Land-Sea New Passage.

5.5 Guarantee Measures

To promote the high-quality development of low-altitude logistics infrastructure along the Western Land-Sea New Passage, corresponding supporting measures are needed to ensure the implementation and effectiveness of all tasks. First, strengthen organizational leadership. It is suggested to establish a working group for low-altitude logistics development to coordinate the work of low-altitude logistics. Second, improve the legal system. It is recommended to promote the revision and improvement of local regulations, adding relevant content on low-altitude logistics. Third, establish an assessment and evaluation mechanism. It is suggested to incorporate low-altitude logistics development into the assessment and evaluation system for the construction of the Western Land-Sea New Passage, and conduct regular evaluations of the development of low-altitude logistics by all regions and departments. Fourth, create a favorable public opinion atmosphere. It is recommended to strengthen the promotion of low-altitude logistics, popularize knowledge about low-altitude logistics, and increase public awareness and acceptance of low-altitude logistics.

6. Conclusion

This paper takes the national strategic project, the Western Land-Sea New Channel, as the research background, closely focusing on the upcoming navigation of the Pinglu Canal and the rising of low-altitude economy as a national pillar industry. It systematically explores the theoretical basis, collaborative mechanism, practical challenges, and governance paths of low-altitude logistics infrastructure planning. The research first constructs a theoretical analysis framework of "spatial layout - channel collaboration - network integration - governance innovation", clarifies the connotation of low-altitude logistics as an important supplement to the comprehensive logistics system, and based on the theories of spatial layout, network form, and system collaboration, explains its deep coupling logic with the Western Land-Sea New Channel in terms of functional complementarity, spatial connection, and operational collaboration.

In response to the current practical bottlenecks such as fragmented planning systems, strict airspace management, inconsistent technical standards, insufficient regional collaboration, and shortage of funds, this paper proposes systematic countermeasures. The research holds that to promote the high-quality development of low-altitude logistics in the Western Land-Sea New Channel, it is necessary to adhere to the principles of demand orientation and local adaptation, and focus on promoting the deep integration of low-altitude logistics with the port logistics of the Beibu Gulf, the waterway transportation of the Pinglu Canal, railway logistics, and cross-border logistics, and constructing a multi-level network layout of "core hub - regional node - terminal facility".

In terms of mechanism design, this paper advocates the construction of a "five-in-one" working pattern: improving top-level design, formulating special regional collaborative development plans; innovating institutional mechanisms, establishing cross-regional and cross-departmental collaborative promotion and comprehensive supervision models; accelerating infrastructure construction, prioritizing the layout of core hubs and filling

the gaps in the end facilities; strengthening policy support, optimizing the development environment through fiscal subsidies, PPP model innovation, and land and talent guarantees; and implementing organizational guarantees, improving the legal system and assessment and evaluation mechanisms.

References

[1] Zhang Yu. Path for the Construction of the New Western Land-Sea Corridor to Boost High-Level Opening-up of Guangxi. New West, 2026(7): 154-158.

[2] Deng Yuanyuan, Wang Yebin, Lu Xiaoxiao. Research on the New Western Land-Sea Corridor and Market Integration in Western China. Southwestern University of Finance and Economics Press, 2026.

[3] Fu Hui, Cui Yu, Zhao Jiahong, et al. Review on Research and Application of Low-altitude UAV Logistics Distribution. Industrial Engineering Journal, 2025, 28(1): 9-21.

[4] Zhu Yonglin. The Promoting Effect of Low-altitude Logistics on the Innovation of E-commerce Logistics Mode. China Shipping Weekly, 2025(12): 74-76.

[5] Zhao Jinglong. High-quality Development of Low-altitude Economy: Connotation Characteristics, Constraints and Breakthrough Paths. Contemporary Economic Research, 2025(4): 27-42.

[6] Wu Fenghua, Fu Huan. Internal Logic, Mechanism and Promotion Path of Emerging Pillar Industries Empowered by Artificial Intelligence. Journal of Fujian Normal University (Philosophy and Social Sciences Edition), 2026(2): 84-96.

[7] Yang Kaizhong. Core Propositions, Paradigm Breakthroughs and Governance Enlightenments of New Spatial Economics. Economic Geography: 1-16 [2026-08-17].

[8] Zhou Xueyan, Sun Chenxing, Zhou Xin. Research on Resilience Recovery Strategy of Multi-mode Transportation Network in Urban Agglomerations. Journal of Transportation Systems Engineering and Information Technology: 1-20 [2026-08-17].

[9] Huang Qixiang, Jiang Zhibin. Construction of Evaluation Index System for Port Group Collaborative Layout and Practical Exploration of Shenzhen Port. Journal of Traffic and Transportation Engineering, 2026, 26(2): 79-93.

[10] Chen Baolian, Zhang Wensong, Wang Jiayuan, et al. Measurement of Platform Enterprises' Social Responsibility Governance and Its Influence Mechanism. Soft Science: 1-14 [2026-08-17].

[11] Xiang Yuqiong, Zhu Rensen. Responsive Adaptation of Cross-sector Collaborative Governance in Complex Situations. Jiangsu Social Sciences: 1-11 [2026-08-17].

[12] Wei Houkai, Nian Meng, Li Le. China's Regional Development Strategy and Policies during the 14th Five-Year Plan Period. China Industrial Economics, 2020(5): 5-22.

[13] Yu Fawen, Lin Shan, Zhang Wei. From "Farmland" to "Cloud": Mechanism and Path of Low-altitude Technology Reshaping Green Agricultural Industrial Chain. Social Science Journal, 2026(4): 172-185+243.

[14] Yang Lijun. Research on Mechanism and Countermeasures of Logistics Industry for Economic Agglomeration and Diffusion. Logistics Technology, 2012, 31(15): 173-174+247.

[15] Liu Wei. Scientific Understanding and Practical Development of New-quality Productive Forces. Economic Research Journal, 2024, 59(3): 4-11.

[16] Wang Jiao'e, Du Delin. Geographical Interpretation of Low-altitude Economy and Theoretical Analysis of Low-altitude Human-land System. Resources Science, 2025, 47(8): 1628-1639.

[17] Zhang Yi, Xie Si. Evolution Logic, Dilemmas and Innovative Paths of China's Low-altitude Economy Regulation. China Business and Market, 2025, 39(10): 83-97.

[18] Liu Yongtuan, Liu Shuo, Du Qingsong, et al. Research on Logistics Industry Efficiency Measurement and Influencing Factors of the New Western Land-Sea Corridor. Railway Transport and Economy: 1-10 [2026-08-17].

[19] Zu Wei, Qiu Bing, Wang Xiaofeng, et al. Research Progress on Application of Unmanned Aerial Vehicle in Public Health Field. Disease Surveillance, 2026, 41(6): 757-764.

[20] Hu Ningning, Hou Guanyu. Research on Agricultural Supply-chain Resilience Empowered by Low-altitude Economy in the 15th Five-Year Plan Period. Journal of

Zhengzhou University (Philosophy and Social Sciences Edition), 2026, 59(2): 84-91.
[21] Tang Junwei, Huang Chengfeng, Lei Yang. Coordination Degree and Influencing Factors between Transportation Advantages and Economic Development. Highway, 2025, 70(12): 244-251.
[22] Liu Hongzhen. Financial Support for Accelerating the Construction of the New Western Land-Sea Corridor. China Finance, 2026(2): 48-50.

