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Cash Flow Formation and Development Mechanisms for Low-Altitude Infrastructure: A Comparative Case Study of Projects with Different Revenue Models in Shenzhen

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Abstract: Whether the operations of low-altitude infrastructure can generate stable, identifiable, and sustainable project cash flows is a central issue in asset development. Focusing on cash flow formation, this study examines four projects in Shenzhen: Yanluo Low-Altitude Economy Industrial Park, Fengyi Bao'an Low-Altitude Smart Logistics Operations Center, Phase I of the Shenzhen Low-Altitude Operations Headquarters Base, and SILAS Phase I. Drawing on publicly available information, it compares these cases across six dimensions: assets and income rights, cash flows and costs, market demand and contractual relationships, construction and operational compliance, operational use, and risk responsibilities. It also examines how different contractual arrangements influence cash flow formation. The findings identify distinct challenges for each project type. Industrial parks require leases and actual collection records to improve the reliability of rental income forecasts. Logistics nodes require separate pricing to clarify the attribution of network revenue to individual facilities. Takeoff and landing bases can convert part of their future usage demand into payment commitments through capacity reservations and similar arrangements. Digital platforms require clearly defined revenue and cost boundaries for different services to identify actual net income. These mechanisms remain subject to risks associated with vacancy and rent arrears, operator creditworthiness, actual usage demand, and contract renewal and technological substitution, respectively. The study identifies differentiated asset development priorities and the conditions under which they apply, providing a comparative analytical framework for developing different types of low-altitude infrastructure assets and preparing them for subsequent securitization.

Keywords: Low-altitude infrastructure; Publicly offered REITs; Cash flow; Asset development; Comparative case study

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1. Introduction

The low-altitude economy is evolving from individual applications toward the coordinated development of infrastructure, operational services, and industrial ecosystems. As drone logistics, low-altitude passenger

transport, general aviation, and flight management expand, industrial parks, logistics nodes, takeoff and landing bases, and digital flight service platforms are developing rapidly. Their value depends not only on construction scale but also on sustained usage and operating revenue. However, some projects are still exploring operating models and cultivating demand, meaning that construction completion does not guarantee stable cash flows. Usage frequency, payment arrangements, operating entities, revenue attribution, and maintenance and renewal costs all affect net operating income. Converting operations into stable, identifiable, and sustainable project cash flows is therefore essential for asset revitalization and subsequent securitization.

Publicly offered infrastructure real estate investment trusts (REITs) depend substantially on the continuing cash flows of their underlying projects. Existing research emphasizes asset quality, income sustainability, operational management, pricing, and risk control, and identifies rental income, tolls, and operating charges supported by clear income rights as key sources of infrastructure value. Low-altitude infrastructure, however, is network-based and technology-dependent, often involving multiple functions and operators. Industrial output does not equal park rental income; logistics order volume does not equal node revenue; takeoff and landing capacity generates cash flow only when supported by actual demand and payment obligations; and digital platforms must distinguish public functions from commercial services. The key issue is whether operational value can be translated into project-level cash flows through clear relationships among assets, services, contracts, revenue, and costs.

Accordingly, this study examines cash flow formation before low-altitude infrastructure is included in a publicly offered REIT. Using four project types in Shenzhen, it compares services, contractual payment obligations, and the allocation of operating and renewal costs. Space-leasing projects require verified lease performance and collections; network nodes require clear revenue attribution and separate pricing; takeoff and landing facilities must convert potential demand into payment commitments; and digital platforms must define commercial service boundaries and match revenue with costs. This study thereby provides a comparative framework for asset development, operational improvement, and subsequent securitization preparation.

2. Literature review

Research on infrastructure REITs provides a foundation for understanding income-generating assets. Yi [1] analyzed the determinants of expressway REIT prices; Lu and Wen [2] examined the relationship between pilot REIT programs and capital markets; Zhang [3] discussed institutional improvements; and Ren *et al.* [4] investigated operating models. Approaching the subject through pricing, financing, rights structures, and operational management, these studies show that asset value requires support from operating income and institutional arrangements. For facilities with established operational scenarios but incomplete income records, however, further analysis is needed to explain how revenue attribution and contractual relationships can be established.

Studies of securitization and risk emphasize asset compliance, income sustainability, and operational risks [5,6]. Cases involving industrial parks and airports discuss financing conditions in terms of rent, occupancy rates, fee-based services, and operating terms [7–9], providing useful reference points for examining the revenue foundations of different facilities. Low-altitude projects also involve network dispatch, data use, and public administration functions, and the asset owner, service provider, and fee-collecting entity may be different parties. It is therefore necessary to examine specific services and contractual relationships to determine

which revenues can be attributed to the assets proposed for inclusion and which risks remain controlled by external operators.

Research on financial support for the low-altitude economy mainly considers how funding supports technological research and development, enterprise growth, and industrial chains. Wang and Gao [10] investigated pathways for support through technology finance; Shen and Kang [11] examined coordination among fiscal support, capital, and insurance; and Meng *et al.* [12] discussed commercial banks' services for industrial chains. Research on safety regulation also highlights the constraints that flight safety requirements place on operations [13]. Building on these studies, this paper examines how facilities generate measurable project revenue after entering service and compares the functions and limits of different contractual arrangements. It connects discussions of industry financing with analysis of the income generated by underlying facilities, without treating industry development as a direct proxy for project maturity.

3. Case study design and evidence organization

3.1. Case selection and comparative relevance

This study examines four projects in Shenzhen: Yanluo Low-Altitude Economy Industrial Park, Fengyi Bao'an Low-Altitude Smart Logistics Operations Center, Phase I of the Shenzhen Low-Altitude Operations Headquarters Base, and SILAS Phase I. Representing an industrial park, a logistics node, a takeoff and landing base, and a digital platform, they cover typical cash flow scenarios with different functions, operating models, users, and revenue sources.

The study combines case study, comparative research, and financial analysis. It examines each project's functions, operators, users, and revenue sources; compares revenue models, contractual arrangements, cost responsibilities, and risk allocation; and assesses revenue sources, pricing, collections, operating costs, and net income to determine whether operations generate identifiable, sustainable, and attributable net cash flows.

The cases illustrate different revenue conversion mechanisms. Yanluo links leases with actual rent collections; Fengyi concerns the attribution of network revenue to a specific node; the Operations Headquarters Base focuses on converting facility capacity into demand and payment obligations; and SILAS requires clarification of platform services, fee-collecting entities, and operating costs. Their comparison identifies common stages and differentiated mechanisms of cash flow development across revenue models.

3.2. Analytical questions and data processing

The analysis examines how operational scenarios generate identifiable and sustainable project cash flows. It considers the facilities and services provided, control over assets and income, actual users and paying entities, and whether market demand results in transactions. It then examines how leases, service agreements, reservations, and other contracts determine fees, terms, and payment responsibilities. Finally, revenue is assessed alongside operation, maintenance, and equipment renewal costs to identify net project cash flows.

Evidence is drawn mainly from information published by government departments, developers, and operators, as well as tendering, construction, acceptance, and operational documents [14,15]. The observation cutoff is August 2026. Based on data availability, the study organizes evidence on construction scale, functional positioning, commencement of operations, usage, charging arrangements, and operating performance.

3.3. A six-dimensional evidence framework

To enable comparison across different project types, the evidence is organized into six dimensions: asset ownership and income control; cash flow formation and cost structure; market demand and contractual relationships; construction, operations, and compliance; operating capacity and usage; and risk exposure and allocation of responsibilities. See **Table 1**.

Table 1. A six-dimensional evaluation framework for revenue analysis of low-altitude economy projects

Assessment dimension	Key questions
Asset ownership and income control	Clarity of facility ownership, operational control, and attribution of income rights
Cash flow formation and cost structure	Revenue sources and sustainability; allocation of operation, maintenance, and renewal costs
Market demand and contractual relationships	Paying entities, pricing, contract terms, settlement arrangements, and revenue concentration
Construction, operations, and compliance	Completeness of required approvals, permits, and filings; compliance basis for continued operations
Operating capacity and usage	Operational status, usage frequency, business volume, service capacity, and operational continuity
Risk exposure and allocation of responsibilities	Allocation of safety, maintenance, renewal, service interruption, and demand fluctuation risks

4. Cash flow formation and the role of contracts in low-altitude economy projects

4.1. Rental agreements and performance verification at Yanluo Industrial Park

Yanluo Low-Altitude Economy Industrial Park occupies 11,000 m², with a gross floor area of 25,000 m². It accommodates 66 enterprises whose combined output value exceeded RMB 110 million in 2024. Some properties were reportedly offered at RMB 18/m²/month under five-year leases with annual rent increases, indicating an established industrial clustering and leasing setting.

The park's core revenue derives from rent and related service fees rather than tenant output. Although leases specify area, duration, rent, and adjustment mechanisms, contractual rent may differ from actual collections because of vacancies, rent-free periods, arrears, early termination, and defaults. Cash flow stability must therefore be assessed by comparing contractual income with actual collections, rather than relying only on rental rates or tenant numbers.

Cash flow development requires linking each property, leased area, term, and rental rate to its contract and historical collection records. Property management, maintenance, and equipment renewal expenses must also be included to determine the project's net rental income.

4.2. Separate pricing and operator credit exposure at the Fengyi logistics node

Fengyi Bao'an Low-Altitude Smart Logistics Operations Center occupies 900 m², with a gross floor area of 974 m², and began operations in February 2025. Public disclosures report more than 2,000 express parcels per day and profitability in 2024, but do not specify the amount or accounting scope. It therefore remains unclear whether these figures relate to the center, its operator, or the broader logistics network.

Drone logistics is network-based: one order may involve warehousing, sorting, transport, takeoff and landing, and dispatch, while the customer pays for the integrated service. Where revenue comes from related parties or internal settlement, its recognition depends on internal pricing and cost allocation. Network-level

order volume and profitability therefore do not establish independent and stable cash flows for a specific node. The node's services and corresponding revenue and costs must be separately identified.

Accordingly, warehousing, sorting, takeoff and landing support, and other services should have specified volumes, prices, settlement cycles, and cost responsibilities. Fixed fees can compensate for keeping the facility available, while usage-based fees reflect actual business volume. Combining them can reduce sensitivity to short-term order fluctuations.

4.3. Capacity commitments and actual demand at the takeoff and landing base

Phase I of the Shenzhen Low-Altitude Operations Headquarters Base covers 45,589.91 m² within its approved boundary, has a gross floor area of 4,829.27 m², and involves RMB 48.8668 million in investment. It includes an administration building, a helicopter or electric vertical takeoff and landing (eVTOL) area, and a drone area. The project passed its special water and soil conservation acceptance inspection in November 2025. However, disclosures do not sufficiently identify its official operating date, aircraft movements, utilization, charging structure, or operating costs. Construction completion alone therefore does not demonstrate stable operating revenue.

The base can generate revenue only when aviation operators have continuing demand and corresponding payment obligations. If charges depend on aircraft movements or usage, revenue will fluctuate with flight schedules, routes, and demand, while security, maintenance, and equipment support costs remain relatively inflexible. The key issue is therefore whether future demand can be converted into stable and binding payment arrangements.

Capacity reservations, minimum usage commitments, and long-term service agreements can convert part of potential demand into contractual payment obligations and reduce reliance on ad hoc usage. Their effectiveness nevertheless depends on genuine demand, enforceable exit provisions, and customers' payment capacity; contracted commitments alone cannot prove that stable revenue will emerge.

4.4. Service separation and identification of net income at SILAS

SILAS Phase I is a digital platform providing functions such as flight plan processing and low-altitude operations management. Planned route and service-capacity targets represent designed capabilities rather than actual operating volumes, while construction contract values cannot be treated as operating revenue. Complete project-level data on fee-based services, customers, contract terms, operating costs, and cash flows remain unavailable.

Technical functions do not automatically generate operating revenue. SILAS may provide both public administration and commercial services through shared software, data, equipment, and personnel. Without clear service boundaries, charging bases, and cost allocation, it is difficult to identify commercial revenue and may be possible to understate related costs. Cash flow analysis must therefore clarify the relationships among services, paying entities, charging bases, and corresponding expenses.

Cash flow development requires separating different services and matching revenue with costs. Procurement, authorization, or operating contracts should specify the scope, fees, paying entities, and terms of commercial services, while shared systems, personnel, and equipment should be allocated using reasonable rules.

5. Cross-case comparison of mechanisms

Figure 1 summarizes the relationships among services, contracts, costs, and project cash flows.

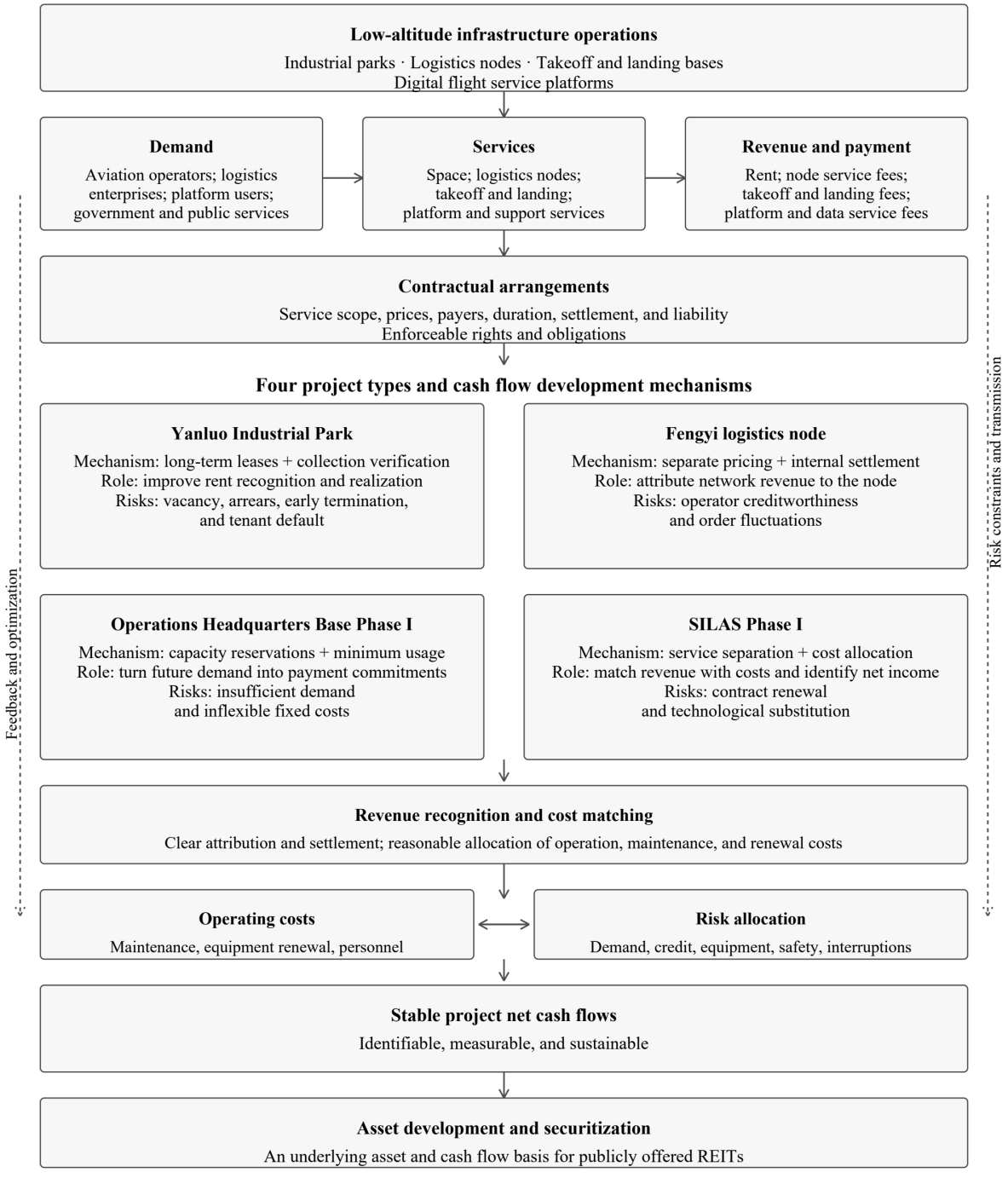


Figure 1. Conversion from operational scenarios to securitizable cash flows in low-altitude infrastructure

5.1. Revenue models and channels for improving cash flows

The four cases differ in cash flow formation and related constraints. Yanluo Industrial Park relies on space leasing and must verify stable rent and collections. The Fengyi logistics node must attribute network earnings to the individual facility. The Operations Headquarters Base must convert facility capacity into sustained paying

demand. SILAS must distinguish commercial services from public functions and identify the related revenue and costs.

Accordingly, industrial parks use leases and collection records to support revenue recognition; logistics nodes use separate pricing and internal settlement to clarify revenue attribution; takeoff and landing bases use reservations and capacity commitments to improve revenue predictability; and platforms use service separation and cost allocation to measure net income. All four mechanisms aim to establish clearer and more stable links between operations and project cash flows.

5.2. Revenue stabilization and risk reallocation through contracts

Contracts can convert uncertain activities into clearer income rights and payment obligations. Long-term leases reduce occupancy fluctuations, fixed service fees provide stable revenue for logistics nodes, and capacity reservations secure part of future demand. Contracts thus improve revenue certainty and reduce reliance on immediate transactions rather than create cash flows directly.

Contracts reallocate rather than eliminate risk. Leases increase dependence on tenant creditworthiness and renewal; fixed fees transfer order risk to paying entities but may concentrate credit exposure; and capacity commitments may transfer demand risk to users. Their effectiveness therefore depends not only on duration and value but also on the allocation of default, termination, suspension, and maintenance risks.

5.3. Management benefits and conditions for portfolio diversification

Combining projects may create management efficiencies through standardized contracts, fees, and accounting practices. However, projects dependent on the same operator, payer, or network remain exposed to common shocks, so adding assets does not necessarily reduce risk.

Effective diversification requires different risk sources. Logistics nodes face operator and payer concentration; industrial parks face tenant and lease-structure risks; takeoff and landing facilities depend on regional demand and customer sources; and platforms face technology supplier and system-upgrade risks. Portfolio management reduces overall volatility only when revenue sources and major risks are sufficiently differentiated.

6. Conclusion

Based on four types of low-altitude infrastructure projects in Shenzhen, this study finds that the completion or operation of a facility does not necessarily mean that securitizable cash flows have been established. Operational activities can be converted into stable, identifiable, and sustainable net project income only when income rights, paying entities, contractual relationships, and cost responsibilities are clearly defined. Asset development priorities vary across project types: industrial parks should verify rental stability through lease agreements and actual collections; logistics nodes should clarify the attribution of network revenue through separate pricing; takeoff and landing bases should use capacity reservations and similar arrangements to convert actual demand into payment commitments; and digital platforms should distinguish commercial service boundaries and appropriately match revenue with costs. Contracts can improve revenue certainty but cannot replace genuine demand and continued performance. Risks such as vacancies and rent arrears, payer credit risk, insufficient demand, and technological substitution must therefore remain under consideration. Accordingly, low-altitude infrastructure should adopt differentiated asset development strategies based on its revenue model,

focusing on establishing clear and verifiable links among operational scenarios, contractual arrangements, and net project cash flows.

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Disclosure statement

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