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Research on the market-oriented investment and financing pathways for China's low-altitude infrastructure construction: with reference to the FAA eVTOL integration pilot program

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Abstract. China's low-altitude infrastructure construction highly relies on government finance, a commercial closed loop has not yet been formed, and investment and financing difficulties have become increasingly prominent. It is urgent to explore a localized path to transform from "government transfusion" to "market hematopoiesis". By analyzing current situation, difficulties and underlying causes of investment and financing in low-altitude infrastructure, and taking Federal Aviation Administration (FAA) eVTOL Integration Pilot Program (eIPP) as a reference, it analyzes its core logic of relying on operational certainty to activate market-oriented investment, and combines the unique institutional environment to complete localization transformation. The research found that the key to breaking the impasse lies in building an endogenous value cycle system of "scenario-data-capital-infrastructure" and establishing a dual-drive collaborative mechanism with central state-owned enterprises' "patient capital" as the backbone and social capital as the vitality engine.

Keywords: low-altitude economy, infrastructure construction, marketization, eVTOL Integration Pilot Program (eIPP)

1. Introduction

The low-altitude economy refers to the use of civil manned and unmanned aircraft in low-altitude airspace to deliver various application scenarios such as low-altitude passenger transport, logistics distribution, cultural tourism and sightseeing, and emergency rescue, which is reshaping urban transportation and public service systems [1]. In March, the government work report clearly positioned the low-altitude economy as an emerging pillar industry, indicating that the sector will shift from conceptual exploration to large-scale development. The development of the low-altitude economy cannot be separated from infrastructure construction. The completion of vertical takeoff and landing sites, energy infrastructure, communication, navigation and surveillance networks, and airspace management systems is a prerequisite for the realization of application scenarios [2]. However, at present, low-altitude infrastructure in most parts of China mainly depends on government financial input and state-owned enterprise investment. Although regions such as

Shenzhen and Hefei have experimented with various financing models including industrial funds and special bonds, social capital has not participated widely. Over-reliance on public finance not only burdens local governments, but also disconnects construction progress from operational demand. The lack of clear profit models and investment return cycles has kept social capital on the sidelines, leaving the "market hematopoiesis" function unactivated for a long time. As the country with the most developed aviation industry in the world, the United States has formed a unique market-driven model for infrastructure development in the field of advanced air mobility [3]. Therefore, from a regional and national perspective, this study conducts a comparative analysis of the differences between China and the United States in low-altitude infrastructure, and explores a systematic solution suitable for China's national conditions to shift from transfusion to hematopoiesis.

2. Current situation and dilemma analysis of investment and financing for China's low-altitude infrastructure construction

2.1. Current situation of investment and financing for China's low-altitude infrastructure

In 2026, the low-altitude economy became a national strategic pillar industry, and China's low-altitude infrastructure construction entered a period of rapid development. Nearly 31 provinces across the country have written the low-altitude economy into their government work reports, and advanced its layout in line with their own industrial foundations [4]. According to industry statistics, as of early 2026, the total budget of public bidding projects in the low-altitude economy sector nationwide had exceeded 12 billion yuan. The China Academy of Information and Communications Technology predicts that by 2035, the total investment in general airports and various takeoff and landing platforms will reach approximately 1.8 trillion yuan. The number of general airports is expected to hit 2,500 with a total investment of about 1 trillion yuan, and the total investment in various takeoff and landing platforms is projected to reach 770 billion yuan by 2035. Special bonds issued by local governments have become one of the most important funding sources [5]. Statistics show that as of 2026, the cumulative issuance of special bonds for low-altitude infrastructure nationwide had surpassed 15 billion yuan and will continue to grow in the future.

At present, as a national strategic emerging industry, the low-altitude economy has grown rapidly driven by government policy dividends and financial subsidies [6]. Its capital sources mainly rely on local finance and special bonds as the core engine to stimulate investment. For a large-scale low-altitude economic infrastructure project in Hefei, 8 billion yuan of its total 18.6-billion-yuan investment comes from special bond funds. Local governments also generally directly participate in or lead the investment, construction and operation of low-altitude infrastructure through subordinate state-owned capital operation platforms such as urban investment and transportation investment companies. Hangzhou has also stated that it will strengthen support from state-owned capital elements, promote municipal enterprises to set up low-altitude industrial investment funds in line with their core responsibilities and businesses, guide state-owned capital to leverage social capital to participate in the low-altitude economy, and comprehensively expand businesses in fields such as low-altitude infrastructure operation, low-altitude flight support, low-altitude supporting services, and low-altitude industrial investment and incubation.

2.2. Dilemmas of investment and financing for China's low-altitude infrastructure

The "government transfusion" model can rapidly boost the low-altitude infrastructure industry in the short term, but it casts shadows on long-term development.

Investment in low-altitude infrastructure may cost billions or even tens of billions of yuan, featuring large upfront input and long return cycles. At this stage, it is still dominated by government-led financial subsidies and lacks a stable market-oriented operation model [7]. Moreover, against the current background where local governments generally face slowing fiscal revenue growth and pressure from stock debt, relying entirely on government special bonds for upfront investment will not only trigger systemic financial risks [8], but also undermine the sustainable construction and operation of low-altitude infrastructure.

Government-led investment decisions tend to prioritize construction over operation. Project approval is usually tied to indicators such as investment volume and construction speed, with little attention paid to utilization rate and operational efficiency after completion. This may leave some takeoff and landing sites idle for a long time after completion, resulting in huge waste of resources [9]. Second, due to the lack of large-scale real commercial operation data, infrastructure construction and planning are mostly based on theoretical assumptions rather than actual market demand, which easily leads to a mismatch between low-altitude infrastructure layout and regional industrial demand. Finally, persistent reliance on the government will rigidify infrastructure construction standards and schemes, making it impossible to adjust flexibly according to market demand and technological progress, thus stifling market innovation vitality.

2.3. Root cause analysis of the investment and financing dilemma of low-altitude infrastructure

At present, commercial closed loops have generally not been formed in low-altitude application scenarios. Social capital remains wait-and-see in low-altitude infrastructure investment, and the market mechanism has not been activated, leaving "government transfusion" as the only option. Zhu Keli, founding dean of the China Institute of New Economy, pointed out that from the market and investor perspective, the competitiveness of electric Vertical Takeoff and Landing (eVTOL) enterprises should be judged by three types of core indicators, among which the core of scenario closed-loop capability is the adaptability between technology and scenarios [10]. Currently, low-altitude application scenarios are still in the initial stage, with large upfront investment and long payback periods. Business models and profit models are not yet mature, and the uncertainty of market operation will also affect the scale and quality of scenario development [11].

For social capital, the existence of clear regulatory rules is a key factor influencing low-altitude infrastructure investment decisions. The absence of rules will directly push up the risk premium of social capital and dampen its willingness to invest [12]. Although government financial subsidies can break the investment deadlock, they only solve the construction problem, while uncertainty at the operational level remains. Therefore, the reason for social capital's wait-and-see attitude is that large-scale and predictable commercial operation revenue has not yet emerged. This dilemma is common in infrastructure construction: infrastructure investment follows the law of diminishing marginal returns, and the improvement of operational efficiency is the key to driving economic growth [13]. Simply relying on the government's continuous input in the construction side will see diminishing long-term returns. Only by opening up the profit closed loop on the operation side can the investment willingness of social capital be fundamentally activated.

To sum up, the problem with the government transfusion model is that the current market participation in low-altitude infrastructure construction is insufficient, making it hard to form the original accumulation of infrastructure. Without the verification of real and sustainable market demand, blind investment relying solely on financial subsidies cannot generate positive cash flow, and the entire industrial ecosystem lacks endogenous vitality and growth momentum. Therefore, it is imperative to activate market demand as soon as possible to achieve the combination of an efficient market and a proactive government.

3. US experience and reference for market-oriented investment and financing of low-altitude infrastructure

3.1. Strategic positioning of Federal Aviation Administration (FAA) eVTOL Integration Pilot Program (eIPP)

Pursuant to the White House executive order, the FAA announced the first batch of eIPP partners in March 2026, including transportation departments of six states such as Florida, Utah, Texas and Pennsylvania, as well as the Port Authority of New York and New Jersey, the City of Albuquerque and others [14]. Rather than providing direct funding, eIPP is a highly structured "regulatory sandbox" led by the FAA. Without disrupting the existing aviation safety regulatory system, it opens a three-year compliant and controlled commercial operation window for innovative enterprises that have passed the preliminary safety assessment. Under the close supervision of the FAA, participating enterprises can conduct real commercial flight tests in specific areas and routes across 26 US states, covering commercial operations in multiple promising application fields including urban air taxis, regional passenger transport, emergency medical response, freight logistics, and offshore energy operation and transportation.

3.2. Core logic of FAA eIPP

eIPP provides enterprises with a legal and compliant window for commercial verification in real scenarios. Operators can carry out regular test flight operations on pilot-designated routes and obtain valuable data such as operation costs, market pricing acceptance and consumer feedback. These data can reduce uncertainty on the investment side, boost investor confidence, and guide private venture capital into all links of Advanced Air Mobility (AAM) operation. The practice of eIPP reflects how the US federal government hedges market and technological uncertainties with policy certainty. When operators see clear commercial prospects and regulatory trends, they will cooperate with upstream and downstream players in the industrial chain to build infrastructure that meets their own operational needs. The AAM National Campaign, simultaneously advanced by NASA, provides technical support and data specifications for commercial test flights within eIPP by establishing unified scenario test norms and data collection standards, further enhancing the attractiveness of operational data to social capital.

The capabilities of collecting, integrating, analyzing and governing low-altitude data are key supports for the large-scale operation of the low-altitude economy [15]. Through structured pilots, the eIPP mechanism collects and analyzes multi-dimensional data such as aircraft operations and low-altitude weather, providing a decision-making basis for the FAA to formulate relevant standards in the future. This path of feeding rule-making with data, on the one hand, continuously optimizes the institutional environment for low-altitude operation; on the other hand, it provides market entities with predictable regulatory directions, further reducing the long-term policy risk of infrastructure investment and forming a positive cycle of institutional improvement and capital participation.

In addition, the public-private partnership model built by eIPP also serves as an institutional carrier for attracting market-oriented infrastructure investment. The FAA requires all pilot projects to be jointly applied by state or local governments and private enterprises. The government provides airspace resources and safety regulatory frameworks, while enterprises contribute aircraft, operation teams and supporting infrastructure funds, with both sides sharing benefits and risks. Under the framework of government-enterprise cooperation agreements, the FAA and selected participants jointly develop exclusive operation plans to provide compliant commercial test flight channels for participating enterprises. Once operation permits are obtained, infrastructure investment becomes financeable, and supporting facilities will be built continuously, transforming the AAM industry from demonstration projects into an expandable low-altitude transportation network [16].

3.3. Reference value of eIPP for China

The US eIPP provides important insights for China. In the initial stage of the low-altitude infrastructure industry, the government should not only remove obstacles to infrastructure construction, but also carry out institutional innovation through approaches such as building a "regulatory sandbox" model, so as to provide trial-and-error space and operational certainty for the market, and let the endogenous driving force of the market promote infrastructure development. However, there are huge differences between China and the United States in the government-market relationship and industrial development models.

China's governments, especially local governments, have stronger resource mobilization capacity and industrial guidance capacity, and play an important role in promoting regional economic development, which is China's institutional advantage. Therefore, the construction of regulatory sandboxes can be led by local governments, working together with regulatory authorities, industrial players, industry departments and industrial capital to build multi-functional special zones. Second, private capital is a major player in infrastructure financing in the United States [17], and its investment decisions are highly dependent on clear and predictable market-oriented operational returns. In China, infrastructure construction in all fields follows the tradition of being moderately ahead of schedule, and it also serves as an important means to drive economic growth [18]. Waiting completely for the market to mature spontaneously does not align with China's development speed and strategic layout. But China has strong state-owned capital, especially central state-owned enterprises, which provides unique institutional resources for us to pursue an investment and financing path with Chinese characteristics.

Of course, eIPP ignores genuine safety and fair access to a certain extent, and functions as an exclusive industrial accelerator. Therefore, the authors only absorb its logic of activating the market with operational certainty, and then carry out localized and creative transformation in combination with China's institutional advantages.

4. Systematic solutions for the Chinese "endogenous hematopoiesis" model

4.1. Top-level design: building a Chinese version of the "regulatory sandbox"

Drawing on the ideas of eIPP, under the guidance of the central government, this study can encourage qualified regions with relatively complete low-altitude infrastructure to set up "low-altitude economy regulatory sandboxes" or "application demonstration zones". The core task of these "regulatory sandboxes" is to provide a legal and safe environment for test flights and trial operations of audited and promising low-altitude application scenarios, grant conditional and time-limited franchise rights to high-quality enterprises that have passed the comprehensive assessment of technology, safety and operation capabilities, and establish a joint supervision and evaluation mechanism coordinated by local governments, civil aviation regulators, air traffic control departments and industrial technical experts. Local governments should introduce supporting fiscal tools such as first-flight subsidies to help enterprises participating in sandbox test flights and trial operations afford high operating costs in the early stage. In March 2025, the first batch of "regulatory sandbox" pilot projects announced by the Hong Kong SAR Government covered multiple scenarios such as logistics, rescue and inspection, with the government providing venues and supporting facilities for their initial operation [19], which also proves the feasibility of this path.

The "regulatory sandbox" allows operators to deliver flight services, test pricing strategies and explore market demand in the real market, and eventually form profitable business models. All flight activities within the sandbox should be connected to a unified data platform, with valuable data such as flight trajectories, communication perception information and user feedback uploaded in real time. These data will provide a key decision-making basis for refined and intelligent airspace management and urban governance. The government can also use these data to optimize route planning, assess safety risks in advance and intelligently dispatch public resources. More importantly, these operational data are critical to verifying business models and attracting external investment.

4.2. Giving play to the synergistic role of central state-owned enterprises and social capital

In 2026, the State-owned Assets Supervision and Administration Commission of the State Council clarified that central state-owned enterprises should act as long-term capital, strategic capital and patient capital, and serve as the national team and main force in low-altitude infrastructure construction, forming a dual-wheel drive pattern of "central state-owned enterprises + social capital".

4.2.1. Strategic positioning of central state-owned enterprises

Central state-owned enterprises have strengths in strong capital strength, technological accumulation and cross-regional coordination capabilities, and play a leading role in the construction of public-good infrastructure. As patient capital, central state-owned enterprises can significantly improve the total factor productivity of strategic emerging industries by promoting technological innovation and reducing operating costs [20]. In the early stage, they can invest in building national or regional low-altitude airspace management service platforms, high-precision navigation and surveillance networks, airspace digital twin systems, and low-altitude intelligent internet of things. These are public service platforms used by all operators, and their construction by central state-owned enterprises can avoid redundant investment and ensure the security of national airspace data. The input of such patient capital from central state-owned enterprises lays a solid foundation for the early development of the low-altitude economy, greatly reduces systemic risks of the industry, and creates a stable macro environment for the entry of social capital.

4.2.2. Role of social capital

On the national public service platform built by central state-owned enterprises, the vitality of social capital will be fully unleashed. It can focus on infrastructure with clearer investment returns and deep binding to specific operation scenarios. Within cities, social capital can rely on commercial buildings, transportation hubs and residential areas to invest in and build a large number of miniaturized, distributed takeoff and landing points. The revenue of these facilities is directly linked to routes and passenger and cargo flow, and investment decisions are fully oriented to terminal market demand, so as to accurately deliver "last mile" services [21]. Social capital can also build targeted logistics-specific drone takeoff and landing cabinets and storage centers, takeoff and landing and supply points in remote areas, and supporting facilities for low-altitude sightseeing in scenic spots. This division of labor model not only guarantees the public safety of the network through central state-owned enterprises, but also activates the commercial vitality on the scenario side through the flexibility of social capital, thus forming a mutually complementary low-altitude infrastructure network.

4.2.3. Risk sharing and profit sharing model

The investment and financing model led by central state-owned enterprises must be closely integrated with market-oriented mechanisms, and reasonable risk sharing and profit sharing mechanisms must be designed to effectively attract social capital. For the risk sharing mechanism, the government bears political and legal risks such as changes in policies, regulations and planning; central state-owned enterprises, with corresponding technical strength and long-term operation capacity, can bear most construction risks, technical risks and long-term operation risks; social capital, being deeply rooted in the market and best understanding customer needs, can bear market risks related to low-altitude application scenarios. As for profits, private or social capital that invests jointly with central state-owned enterprises can obtain relatively stable basic returns through guarantees and difference supplementation from central state-owned enterprises in the initial operation stage of infrastructure projects, lowering the threshold for participation. When the project matures and cash flow exceeds expectations, an excess profit sharing mechanism can be set up so that all equity investors can share the dividends of industrial development.

4.3. Value cycle mechanism of "scenario-data-capital-infrastructure"

4.3.1. Value discovery: government procurement of services

Before the C-end or B-end commercial market matures, the government's own demand can become the first batch of customers driving the construction and operation of low-altitude infrastructure. Promoting the government service purchase model is an effective way to open up the initial commercial closed loop and obtain the first batch of infrastructure investment [22], and also a policy tool to reduce the uncertainty of the early commercial closed loop. Local governments can package their needs in areas such as urban governance, public safety and emergency response into service contracts and purchase different service models. For urban governance, the government can purchase drone services for security patrols, environmental monitoring and urban 3D modeling in key areas to realize smart city governance; in the field of emergency rescue, it can purchase drone services for forest fire prevention, fire fighting and emergency medical material delivery; in the field of public utilities, it can purchase drone services for automatic inspection and maintenance of power grids and pipelines.

The government or state-owned enterprises, as Party A, can sign 3-5 year long-term service agreements with operators. The agreements shall clearly specify service standards, flight scenarios, flight airspace and payment methods. For operators, this long-term contract can provide a stable and predictable source of income and cash flow. They can verify the reliability of their technology and the feasibility of their services in real scenarios, obtain a large amount of valuable operational data, and ultimately earn both service fees and data fees.

4.3.2. Value amplification: data capitalization

The operational data obtained by the government through purchasing services is a new type of public asset. These data will provide an important decision-making basis for refined and intelligent airspace management and urban governance. The government can use these data to optimize route planning, assess safety risks in advance and intelligently dispatch public resources. Local governments can also take the lead in integrating these data, build a data base, and explore the possibility of listing and trading on data exchanges. Meanwhile, desensitized data on airspace environment, meteorology and geographic information opened to the market can attract many third-party data service providers. Meteorological companies can develop more accurate low-altitude weather forecast services based on these data to predict micro-scale weather; high-precision map companies can update their 3D map data to achieve intelligence; insurance companies can design more precise drone operation insurance products. This will help explore new business models and application scenarios, and further improve the low-altitude economy industrial ecosystem.

4.3.3. Value realization: diversified investment and financing paths

When the "scenario-data-capital" cycle starts, low-altitude infrastructure projects will enter a stable operation stage, with sustainable and predictable cash flow. At this stage, the Public-Private Partnership (PPP) model can be adopted as the dominant form to clarify the division of labor and cooperation in low-altitude infrastructure construction, establish a joint investment mechanism, explore diverse and flexible financing models and instruments, and make real-time adjustments according to the phased progress of infrastructure construction and changes in capital demand [23]. When operations mature, public infrastructure REITs will play a core role. Owners of mature projects such as vertical takeoff and landing hub complexes can issue REITs through various methods such as operation right pledge, usufruct transfer and lease securitization to revitalize stock assets [24]. The revitalized funds can be reinvested in larger-scale infrastructure construction, forming a virtuous cycle of "construction-operation-revitalization-reinvestment". Meanwhile, REITs can attract long-term institutional investors such as insurance funds and pension funds that pursue stable returns, further broadening funding sources. At present, there are no actual cases of public REITs for low-altitude infrastructure in China, but it provides a clear and feasible capital exit and circulation path for the "market hematopoiesis" model. If this path works, a complete commercial closed loop will be formed.

5. Conclusion

Overall, the investment and financing of low-altitude infrastructure requires appropriate institutional innovation by the government to provide operational certainty for operators, and full play to the advantages of patient capital such as central state-owned enterprises to attract in-depth participation of social capital, so as to form the cycle mechanism of "scenario-data-capital-infrastructure". This can not only solve the investment and financing problems of low-altitude infrastructure, but also provide reference for the construction of other new-type infrastructure facing the same dilemma. This study also has limitations. Since the low-altitude economy is still in the early stage of development and the degree of airspace opening varies across regions, the operation efficiency of the cycle mechanism requires more accurate evaluation methods and tools. Future research will further examine the impact of China's military-local-civilian collaborative airspace management on the construction and investment of low-altitude infrastructure.

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