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Research on the Financing Status, Dilemmas, and Optimization Paths of Low-Altitude Economy Enterprises under the Digital Economy

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Abstract

As a vital carrier of new quality productive forces and a nationally strategic emerging industry, the low-altitude economy is entering a critical window of scale-up development; however, its financial supply system significantly lags behind the pace of industrial expansion. Against the backdrop of deep integration between the digital economy and the low-altitude economy, this paper adopts a mixed-methods approach combining literature review, policy text analysis, and semi-structured interviews to systematically examine the financing status of low-altitude economy enterprises, analyze their dilemmas and underlying causes, and propose optimization paths. The study finds that the financing of low-altitude economy enterprises exhibits a structural feature of "debt-financing dominance, insufficient direct financing, and high policy dependence." The mismatch between asset-light structures and collateral logic, the absence of rights confirmation, valuation, and disposal mechanisms for data assets, and the dual uncertainty of policy and technology jointly constitute the core causes of financing constraints, while the financing pain points of the three enterprise types—R&D-oriented, operation-oriented, and infrastructure-oriented—show significant heterogeneity. The digital economy can build a tiered and classified financing model, open the transformation channel of "data resources—data assets—data capital," and, supported by risk-sharing and digital risk-control mechanisms, systematically reduce financing costs and information asymmetry. This paper provides a reference for low-altitude economy enterprises to broaden financing channels and for relevant stakeholders to optimize decision-making.

Keywords: Low-Altitude Economy; Digital Economy; Financing Constraints; Data Assets; Intellectual Property Securitization; Optimization Paths

1. Introduction

General Secretary Xi Jinping emphasized that "technological and industrial innovation is the fundamental path to developing new quality productive forces." Relying on low-altitude airspace and using unmanned aerial vehicles (UAVs), electric vertical take-off and landing aircraft (eVTOLs), and general aviation aircraft as carriers, the low-altitude economy radiates and drives a long-chain industry covering whole-aircraft manufacturing, core components, operation services, infrastructure, and information and communication support. Possessing the salient features of new space, new technology, and new drivers, it has become a new high ground for cultivating new quality productive forces and competing in global science and technology (Zhang, 2025). Liu Yaya et al. systematically defined the conceptual connotation and development characteristics of the low-altitude economy, pointing out that China's low-altitude economy is still in its infancy, exhibiting a stage-specific feature of coexistence between an early phase and rapid growth (Liu, et al.,2025). Since the 2021 "National Comprehensive Three-Dimensional Transportation Network Planning Outline" first included the low-altitude economy in a national plan, China has continuously improved its top-level design: at the December 2023 Central Economic Work Conference it was explicitly designated a strategic emerging industry; in 2024 the "Interim Regulations on the Flight Management of Unmanned Aircraft" took effect, and in the same year the low-altitude economy was written into the "Government Work Report" for the first time; in December 2024 the National Development and Reform Commission established a Low-Altitude Economy Development Department; and by early 2025 about 30 provinces had included the low-altitude economy in their provincial government work reports. The industrial scale has expanded rapidly in parallel. According to CCID Consulting's "China Low-Altitude Economy Development Research Report (2024)," China's low-altitude economy market reached 505.95 billion yuan in 2023 and grew to 670.25 billion yuan in 2024 (CCID Consulting, 2024); the Civil Aviation Administration of China (CAAC) projects that the market will reach 1.5 trillion yuan in 2025 and is expected to exceed 3.5 trillion yuan by 2035.

In sharp contrast to the industry's fervor, the financial support system for low-altitude economy enterprises remains at an early stage. Low-altitude industries are characterized by large R&D investment, long verification cycles, complex airworthiness certification, lagging profitability, and few collateral assets. Enterprises generally face the financing difficulty of "high R&D investment, lagging profitability, and few collateral assets," and some leading enterprises have even repeatedly encountered capital-chain risks during the airworthiness certification stage (Yang and Xu, 2026; Liu and Wu, 2025). Traditional bank credit, centered on fixed-asset collateral and stable cash flow, is naturally mismatched with the asset structure of low-altitude enterprises, which is dominated by intangible assets such as patents, software copyrights, and flight data. Venture capital and industry funds, meanwhile, are highly concentrated in whole-aircraft manufacturing and infrastructure, leaving R&D- and operation-service-oriented SMEs significantly under-covered (Mei, 2025). At the same time, the rapid development of the digital economy is reshaping the underlying logic of financing: new mechanisms such as big-data risk control, blockchain notarization and traceability, IoT device monitoring, privacy computing, and data-asset inclusion in financial statements provide technological possibilities for resolving the

information asymmetry and insufficient credit of asset-light enterprises (Chen and Yang, 2025; He and Hao, 2025; Zhou et al., 2025).

Thus, a question of both theoretical value and practical urgency arises: under the digital economy, what is the actual financing status of low-altitude economy enterprises? What are the core dilemmas and causes constraining their financing? How can digital technology be embedded into financing instrument design to form actionable optimization paths? Existing research mostly focuses on macro-level industrial logic and policy reviews, lacking systematic investigation of the financing behavior of low-altitude economy enterprises as micro-level entities, and has not fully discussed the scenario-based integration of digital technology and financing instruments (Yang and Xu, 2026; Mei, 2025). In view of this, taking low-altitude economy enterprises as the research object and integrating literature review, policy text analysis, and in-depth enterprise interviews, this paper proceeds along the logic of "status depiction—dilemma diagnosis—path optimization" to provide a reference for industrial practice and policy making.

The marginal contributions of this paper are mainly reflected in three aspects. First, in terms of research perspective, it integrates the asset-valuation logic of accounting with fintech instrument design, introducing the chain of "asset digitalization—financing instrumentalization—capital marketization" into the study of low-altitude economy financing. Second, in terms of research content, it distinguishes the heterogeneous financing needs of three types of enterprises—R&D-oriented, operation-oriented, and infrastructure-oriented—avoiding treating low-altitude economy enterprises as a homogeneous whole. Third, in terms of practical value, based on first-hand interview materials and the latest industry cases, it proposes a tiered and classified financing model and supporting mechanisms, forming actionable policy recommendations.

2. Literature Review and Theoretical Analysis

2.1. Research on Digital Economy Empowering Corporate Financing

Classical financing theory holds that information asymmetry is the root cause of SME financing constraints. Stiglitz and Weiss (1981) pointed out that in a credit market with imperfect information, banks cannot achieve clearing by raising interest rates and instead adopt credit rationing, systematically excluding high-risk, asset-light enterprises from the credit market (Stiglitz and Weiss, 1981). Berger and Udell (1998) further proposed the "financial growth cycle" theory, arguing that enterprises mainly rely on internal financing and angel investment in the start-up stage, gradually entering bank credit and capital markets as information transparency improves, and that advances in information-production technology can significantly advance this transition node (Berger and Udell, 1998).

The rise of the digital economy is changing this information-production function. Recent domestic studies have generally found that digital technology alleviates financing constraints through three paths. The first is the signaling path: institutional arrangements such as data-asset inclusion in financial statements send the market a dual signal of "resource acquisition" and "information improvement," enhancing investors' expectations of enterprises' future cash flows (Chen and Yang, 2025). The second is the empowerment path: He and Hao (2025), using the

2018 supply-chain innovation and application pilot as a quasi-natural experiment, found that supply-chain digitalization improves enterprises' resource conditions and information environment through three mechanisms—psychological empowerment, knowledge empowerment, and resource empowerment (He and Hao, 2025). The third is the risk-control optimization path: big-data risk control incorporates non-financial information such as operating cash flows, order collections, and qualification certifications into credit evaluation, forming a substitution of technological credit for collateral credit. In addition, Cao et al. (2025), based on the TOE framework, conducted a configuration analysis of 85 A-share listed companies that had completed data-asset inclusion in financial statements in 2024, finding that enterprises achieving a high level of data-asset inclusion follow three synergistic paths—finance-driven, policy-driven, and comprehensive-driven—indicating that data assetization cannot rely on a single condition (Cao et al., 2025). However, existing studies also point out the boundaries of digital empowerment: data-asset inclusion faces three major problems—data rights confirmation, data security, and value measurement—while data-asset financing faces prominent obstacles such as difficulty in rights confirmation, lack of valuation standards, and poor disposal channels, and the business entities tend to be state-owned enterprises with financing models concentrated in bank credit, leaving diversification insufficient (Zhou et al., 2025; Tan and Zhang, 2024).

2.2. Research on Financing Characteristics of Low-Altitude Economy Enterprises

As an emerging industry, research on the financing of the low-altitude economy is still at an early stage. Existing literature mainly proceeds at the industrial level: Zhang and Xu (2024) pointed out that the constraints on the development of the low-altitude economy industrial chain mainly include four aspects—overall weak foundational industrial-chain capability, insufficient ecosystem support, imperfect coordination mechanisms, and inadequate precision of industrial-policy support—which should be optimized on the basis of adhering to the two principles of autonomous control of core technologies and development suited to local conditions (Zhang and Xu, 2024). Sun et al. (2025), based on the TOE framework, conducted a configuration analysis of 343 listed companies with low-altitude concepts, finding that a single element does not constitute a necessary condition for enterprise incubation, but there is an obvious factor-substitution effect among "capital injection," "intellectual property," and "enterprise human resources," and the geographic distribution of enterprises shows a pattern of "dense in the east, sparse in the center, scarce in the west" (Sun et al., 2025). Yang and Xu g (2026), using the difference-in-differences method, found that science and technology finance policies significantly improved the innovation quality of low-altitude-related enterprises, mainly through two paths—improving R&D efficiency and financing efficiency—with a more pronounced effect on samples with high financing constraints (Yang and Xu, 2026). These studies provide a basis for understanding the financing environment of low-altitude economy enterprises, but overall, research focusing on the financing behavior of low-altitude economy enterprises remains scarce, mostly qualitative, and lacks empirical support based on first-hand enterprise data (Liu and Wu, 2025; Mei, 2025).

2.3. Application Research on Innovative Financing Instruments

At the instrument level, scholars have discussed science and technology innovation notes, intellectual property securitization, asset-backed securities (ABS), financial leasing, and policy-

based finance. Liu and Wu (2025) discussed the development of the low-altitude economy and its financial support, emphasizing the need to build a financial service system adapted to the characteristics of the low-altitude industry (Liu and Wu, 2025). Mei Shuyuan (2025) reviewed the connotations and global development process of the low-altitude economy, explored the theoretical mechanism by which policy-based finance empowers the low-altitude economy, and proposed that support paths should be designed based on the main responsibilities and scope of policy-based finance while responding to the objective needs of low-altitude economy development (Mei, 2025). Regarding intellectual property securitization, existing studies note that patent-portfolio valuation is more suitable for R&D-intensive enterprises, while issuance thresholds and the dispersion of underlying assets are the main obstacles restricting SME participation. Regarding data-asset financing, Zhou et al. (2025) found that data-asset financing businesses have grown rapidly since 2024, yet suffer from the lack of unified policy guidance, single models, a bias toward state-owned entities, and enterprises emphasizing financing effects while neglecting data development.

3. Research Design

3.1. Research Methods

This paper adopts a mixed research design combining literature review, policy text analysis, and semi-structured interviews. First, literature review is used to sort out the theoretical mechanisms by which the digital economy empowers financing and the existing conclusions on low-altitude economy financing, constructing the analytical framework of this paper. Second, text analysis is conducted on low-altitude-economy, science-and-technology-finance, and data-factor policy documents at the national and local levels to clarify the types and coverage of policy instruments. Finally, semi-structured interviews are used to obtain first-hand enterprise data, identify financing pain points, and verify the feasibility of innovative financing models.

3.2. Data Sources

The data sources of this paper include three types. First, public data and industry cases, including industrial-scale data disclosed by the CAAC, the National Development and Reform Commission, and others, as well as the public practices of financial institutions such as Huaxia Bank’s 104-million-yuan low-altitude economy asset-backed plan, Shanghai Pudong Development Bank’s establishment of a low-altitude financial service research society, and Agricultural Bank of China’s 3-billion-yuan eVTOL leasing order. Second, policy texts covering national-level low-altitude-economy special policies and special-bond, industry-fund, and interest-subsidy policies issued by Sichuan, Anhui, Hefei, and other places. Third, first-hand interview materials: the research team conducted a telephone interview in May 2026 with the deputy general manager of Hebei Chunjiu Intelligent Technology Co., Ltd., covering the enterprise’s basic situation, financing status and dilemmas, awareness of digital technology and data-asset financing, and needs for innovative financing models, forming an interview record of about 4,000 Chinese characters. The enterprise’s main business covers UAV pilot training, industry application solutions, and youth aviation science and technology education; it is a typical

knowledge-intensive, asset-light low-altitude-economy technology service enterprise, and its financing situation is highly representative among low-altitude economy SMEs.

3.3. Analytical Framework

This paper constructs a three-dimensional analytical framework of "asset characteristics—financing instruments—institutional environment." The asset-characteristics dimension characterizes enterprises' structural features dominated by intangible assets such as patents, data, and qualifications. The financing-instruments dimension examines the availability and cost of traditional credit, equity financing, and innovative instruments. The institutional-environment dimension concerns policy supply, rights-confirmation rules, and risk-sharing mechanisms. Together, the three determine the intensity of financing constraints on low-altitude economy enterprises and provide a logical basis for the tiered and classified optimization paths proposed later.

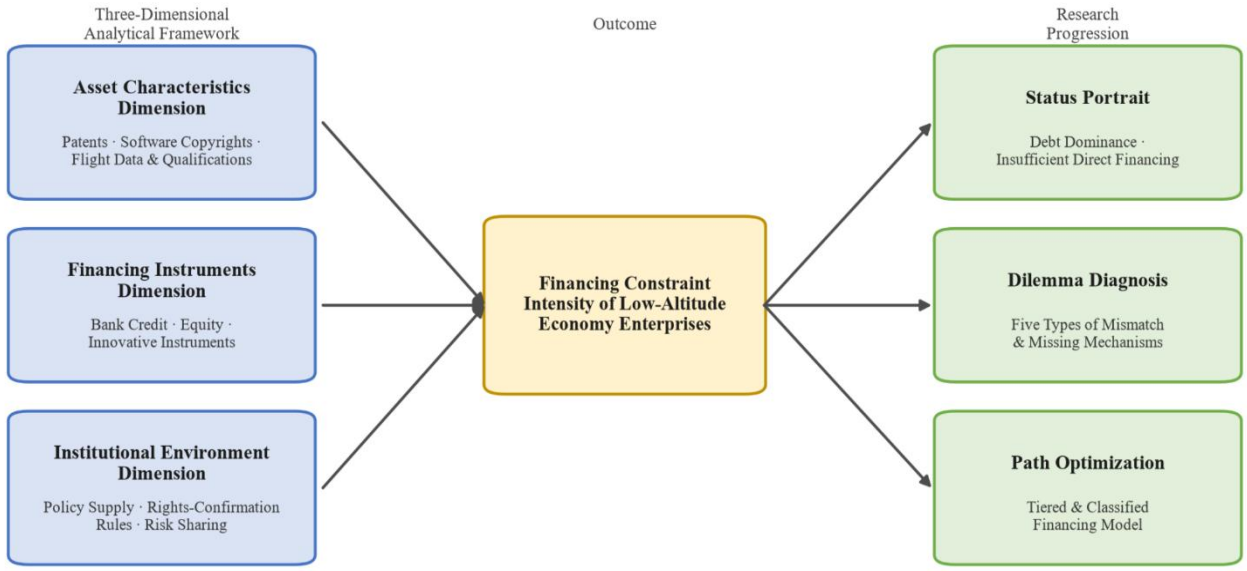


Figure 1. Three-Dimensional Analytical Framework of "Asset Characteristics—Financing Instruments—Institutional Environment"

4. Financing Status of Low-Altitude Economy Enterprises under the Digital Economy

4.1. Rapid Industrial Expansion Drives Concentrated Release of Financing Demand

The low-altitude economy has entered a critical stage of moving from technology verification to commercial operation, and its financing demand exhibits the characteristics of large scale, long tenor, and high frequency. From the supply side, whole-aircraft manufacturing and core-component enterprises need continuous investment in airworthiness certification and capacity building. From the demand side, operation-service enterprises need to procure aircraft in batches and build take-off/landing sites and training systems. From the support side, new infrastructure such as air-traffic-management systems, communication navigation, and low-altitude digital platforms has obvious public-good attributes and longer investment payback periods. According to CCID Consulting, China's low-altitude economy market reached 505.95 billion yuan in 2023

and grew to 670.25 billion yuan in 2024 (CCID Consulting, 2024); the CAAC projects it will reach 1.5 trillion yuan in 2025 and is expected to exceed 3.5 trillion yuan by 2035. Such a magnitude of industrial expansion will inevitably create capital demands far exceeding the current supply capacity of the financial system.

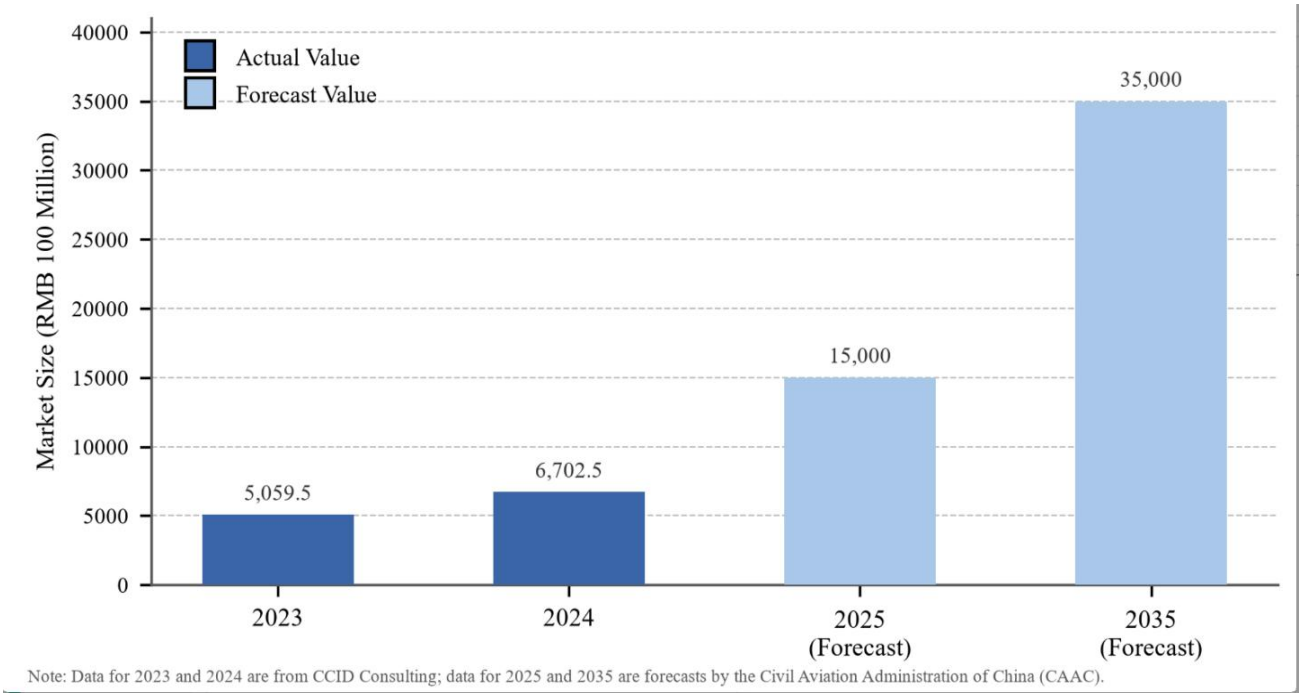


Figure 2. China's Low-Altitude Economy Market Size and Forecast, 2023–2035

4.2. Financing Channels Exhibit a Structure of "Debt Dominance, Insufficient Direct Financing, and High Policy Dependence"

Current financing channels for low-altitude economy enterprises mainly include four types: internal financing, bank credit, equity financing, and policy funds. Structurally, three salient features emerge (Table 1). First, debt financing—especially short-term bank credit—dominates, yet credit lines are generally limited and highly dependent on enterprise cash flow and compliance qualifications. In the interview, the interviewee stated that financing is "mainly self-owned funds, plus some equity financing and a small amount of bank operating credit loans," that bank credit "mainly depends on whether cash flow is stable and whether compliance qualifications are complete," with long approval cycles and limited lines. Second, the proportion of direct financing is low and highly concentrated: equity financing mainly flows to leading whole-aircraft enterprises and eVTOL enterprises with clear commercialization prospects, while many small operation-service enterprises find it difficult to enter venture capital's field of view. Third, policy-fund dependence is high: industry funds, special bonds, and fiscal interest subsidies have played an important leverage role in infrastructure and equipment manufacturing, but their coverage of R&D-oriented enterprises is significantly insufficient, forming a structural bias of "easy financing for infrastructure, difficult financing for R&D."

Table 1. Comparison of Major Financing Channels for Low-Altitude Economy Enterprises

Financing Channel	Main Providers	Applicable Enterprise Types	Availability	Main Limitations
Internal financing	Enterprise's own accumulation	All types (esp. SMEs)	High but small in scale	Constrained by lagging profitability; hard to support scale-up
Bank credit	Commercial & policy banks	Operation enterprises with stable cash flow & compliance	Medium	Centers on fixed assets & cash flow; hard for asset-light firms
Equity financing	VC, industry capital, gov. guidance funds	Leading whole-aircraft & eVTOL firms	Low (concentrated at top)	Prefers clear commercialization; SMEs overlooked
Policy funds	Special bonds, industry funds, fiscal subsidies	Infrastructure & equipment manufacturers	Medium	Biased to infrastructure; weak coverage of R&D/service firms
Sci-tech innovation notes	Interbank market, lead underwriters	R&D firms with patent accumulation	Relatively low	High issuance threshold; strict on qualification & disclosure
IP securitization	Brokers, exchanges, appraisers	Patent-intensive R&D firms	Low	No unified valuation; high dispersion; poor disposal channels
Financial leasing & leasing ABS	Leasing cos., brokers	Operation firms procuring equipment in batches	Relatively low	Needs scale orders & stable cash flow; SME hard to pool
Data-asset pledge financing	Banks, local data exchanges	Operation firms with flight/operation data	Very low	No rights/valuation/disposal mechanism; no industry standard

4.3. Digital Financial Instruments Begin to Be Piloted but Remain Limited in Scale

Worth noting, the digital economy has begun to embed itself into low-altitude economy financing scenarios, forming several landmark practices. In asset securitization, Huaxia Bank launched a 104-million-yuan low-altitude economy asset-backed plan, providing a standardized financing channel for operation-type assets. In leasing, Agricultural Bank of China reached a 3-billion-yuan eVTOL leasing order, providing a financial solution for the installment use of high-value equipment. At the research and service level, Shanghai Pudong Development Bank established a low-altitude financial service research society to explore an industry-specific credit-

evaluation system. At the data-factor level, some regions have launched urban low-altitude data-asset financing pilots, exploring financing paths using flight data and operating data as underlying assets. In addition, science and technology innovation notes in the interbank market provide short-term R&D funding channels for R&D-oriented enterprises, and intellectual property securitization pilots have been implemented in multiple regions. Overall, however, these innovative instruments remain at the "single-point pilot" stage, with participants mainly large financial institutions and leading enterprises, leaving low-altitude SMEs with low accessibility.

4.4. Coexistence of Regional and Enterprise-Type Differentiation

The financing availability of low-altitude economy enterprises shows obvious dual differentiation by region and type. At the regional level, industrial and financial resources are highly concentrated in eastern provinces such as Guangdong, Beijing, Jiangsu, and Zhejiang, followed by central and western provinces, while enterprises in remote western areas are scarce in number and have more limited financing channels (Sun et al., 2025). At the type level, whole-aircraft-manufacturing and infrastructure enterprises are easier to finance because their assets are relatively mortgageable and policy endorsement is strong; SMEs mainly engaged in application services such as training, mapping, inspection, and plant protection have core assets of course systems, teaching methods, operating data, and industry qualifications, almost no hard mortgageable assets, and the greatest financing difficulty (Table 2). The interviewed enterprise belongs to the latter category, with intangible assets accounting for about half of its asset structure, equipment about 30%, and the rest teaching and operating data and working capital—"the biggest problem is still the asset-light attribute; there are no hard collateral assets, and the bank credit threshold is high."

Table 2. Asset Structure, Financing Needs, and Core Dilemmas of Three Types of Low-Altitude Economy Enterprises

Enterprise Type	Asset Structure Features	Funding Need Features	Core Financing Dilemma	Digital-Tech Breakthrough
R&D-oriented (whole-aircraft, core parts, flight control)	Patents, software copyrights, R&D teams dominate; low fixed assets	Large amount, long tenor; must cross airworthiness cycle	Insufficient collateral; R&D-credit maturity mismatch; tech value hard to price	Consortium-chain traceability + patent-portfolio valuation + sci-tech notes
Operation-oriented (training, mapping, inspection, plant protection, logistics)	Aircraft ~30%; rest are course systems, operation data, qualifications	High frequency, medium ticket; concentrated in batch procurement	Low industry cognition → long approval, limited lines	IoT equipment monitoring + leasing ABS + big-data cash-flow risk control
Infrastructure-oriented (vertiports, ATM, low-altitude digital platforms)	Heavy infrastructure assets; public-good attributes	Long payback; needs long-term capital	Return/liability tenor mismatch; insufficient social capital	Digital special bonds + industry investment alliance + cash-flow

5. Financing Dilemmas and Their Causes for Low-Altitude Economy Enterprises

5.1. Mismatch between Asset Lightness and Traditional Collateral Logic

Low-altitude economy SMEs take intangible assets as their core assets, fundamentally conflicting with commercial banks' evaluation logic of "emphasizing collateral and cash flow." The interviewed enterprise clearly stated that it is "still mainly intangible assets, about half, including course systems, teaching patents, and brand qualifications; equipment is about 30%," and that "some financial institutions do not understand the UAV-training track well, with long approval cycles and limited lines." Theoretically, this is precisely the credit-rationing situation described by Stiglitz and Weiss: lacking verifiable collateral and industry cognition, banks cannot effectively distinguish enterprise quality and can only raise access thresholds to avoid risks, ultimately excluding many high-quality asset-light enterprises (Stiglitz and Weiss, 1981). At the same time, financial institutions generally lack compound talents who understand both aerospace technology and financial pricing, further amplifying the problem of "daring not lend, unable to evaluate."

5.2. Mismatch between R&D/Commercialization Cycles and Credit Maturity

Low-altitude industry technology R&D usually takes 2 to 5 years or longer, and must go through multiple stages such as airworthiness certification, scenario verification, and market cultivation, while bank credit is dominated by working-capital loans within one year, creating a significant maturity mismatch. When describing future plans, the interviewed enterprise mentioned that the short term focuses on stabilizing cash flow, the medium term considers equipment financial leasing, and only the long term may participate in special-bond projects and intellectual property securitization, reflecting the tension between the long-term nature of enterprise funding needs and the short-terming of financial supply. The maturity mismatch not only raises enterprises' liquidity management costs but also forces them to support long-term investment with short-term funds, exacerbating capital-chain risks.

5.3. Lack of Rights Confirmation, Valuation, and Disposal Mechanisms for Data Assets

Low-altitude economy enterprises naturally accumulate large amounts of flight, operation, and training data in their operations. These data have the characteristics of reusability, verifiability, and the ability to generate sustained returns, and theoretically have the potential to become high-quality underlying assets. In practice, however, the financing function of data assets can hardly be exerted. The interviewed enterprise stated, "We have also thought about using data for financing, but there is no unified pricing and rights-confirmation standard in the industry yet, so it cannot be implemented for the time being," and believes that "as long as the problems of rights confirmation, pricing, and compliance are solved, these assets can be revitalized," but "the industry is still in the exploration stage, and large-scale implementation will take time." This is consistent with existing research: data-asset inclusion faces three major problems—data rights confirmation, data security, and value measurement (Tan and Zhang, 2024)—while data-asset financing lacks unified policy guidance, has a single model, and has poor disposal channels (Zhou et al., 2025). As a result, the most active asset form of enterprises cannot enter the balance sheet and thus cannot be transformed into financing capacity.

5.4. Dual Policy and Technological Uncertainty Elevates Risk Premiums

The low-altitude economy faces the dual uncertainty of policy iteration and technology iteration simultaneously. At the policy level, rules on airspace management, airworthiness certification, and flight approval are still being refined, and the intensity and direction of local policies differ. At the technology level, core routes such as battery energy density, flight-control systems, and communication navigation have not yet fully converged, and misselection of technology routes may cause assets to depreciate rapidly. The dual uncertainty makes investors generally adopt a wait-and-see attitude, significantly raising risk premiums and directly pushing up enterprise financing costs. This effect is more pronounced for SMEs lacking stable cash flow and profit records.

5.5. High Thresholds of Innovative Instruments Limit SME Accessibility

Although innovative instruments such as science and technology innovation notes, intellectual property securitization, and ABS have appeared in the market, their issuance thresholds pose substantial constraints on SMEs. Science and technology innovation notes require ratings and scale of the issuing entity; intellectual property securitization requires sufficiently large and quality-stable patent portfolios as underlying assets; ABS strictly requires dispersion of underlying assets and stability of cash flows. The interviewed enterprise admitted, “We haven't used these instruments yet, mainly because self-owned funds and equity financing are basically enough for now,” and in the future “after business expansion, especially when equipment procurement volumes rise, we will consider financial leasing, and we are also learning about intellectual property financing.” This shows that most SMEs are in a state of “heard of it, but can’t use it” regarding innovative instruments, and there is an obvious mismatch between instrument supply and demand.

5.6. Imbalanced Coverage Structure and Regional Distribution of Policy Instruments

Existing policy instruments are structurally biased toward infrastructure and equipment manufacturing, with relatively weak support for R&D-and service-oriented enterprises; regionally, industry-fund and special-bond resources are mainly concentrated in eastern regions with a better industrial base, leaving central and western enterprises less accessible. This dual imbalance not only reduces the efficiency of fiscal fund use but may also reinforce inter-regional industrial gaps, requiring the government to correct it through more targeted institutional design (Sun, Zhang, & Ye, 2025).

6. Optimization Paths for Financing Low-Altitude Economy Enterprises under the Digital Economy

6.1. Constructing a Tiered and Classified Differentiated Financing Model

In view of the heterogeneity of asset structure and funding-demand cycles among R&D-, operation-, and infrastructure-oriented enterprises, differentiated financing schemes should be designed (Table 3).

Table 3. Optimization Path Design for a Tiered and Classified Financing Model

Enterprise Type	Core Financing Instrument Mix	Digital-Tech Support	Risk Mitigation	Policy Support
R&D-oriented	Sci-tech notes+IP securitization+R&D loans	Consortium-chain traceability, patent-portfolio valuation model	IP disposal fund, risk-compensation pool	R&D super-deduction, interest & guarantee enhancement
Operation-oriented	Financial leasing+operation-data pledge+leasing ABS	IoT equipment monitoring, big-data risk control, privacy computing	Equipment buy-back guarantee, low-altitude exclusive insurance	Operation subsidies, scenario procurement, industry-standard recognition
Infrastructure-oriented	Digital special bonds+industry investment alliance+REITs exploration	Low-altitude digital platform, project-return visual disclosure	Government-backed guarantee, long-term patient capital	Special-bond quota tilt, land & airspace support

First, securitization+science and technology innovation notes portfolio. Core patents and software copyrights are used to build patent portfolios as underlying assets; a consortium chain realizes full-process traceability of rights attribution, licensed use, and value circulation, solving the difficulties of intellectual property rights confirmation, traceability, and disposal. Simultaneously, science and technology innovation notes supplement short-term R&D funds, and a "technology potential evaluation" mechanism is introduced to incorporate R&D teams, patent quality, and in-progress projects into credit evaluation, forming a closed loop of "technology value—capital recognition." The interviewed enterprise gave positive feedback: "Blockchain can solve the problems of intellectual property rights confirmation and traceability, while securitization can turn course patents and teaching methods into tradable assets, revitalizing our core competitiveness."

Second, operation-oriented enterprises should adopt an "IoT+leasing ABS" model. The leasehold beneficial rights of aircraft and UAV equipment serve as underlying assets; IoT collects in real time data such as equipment location, running time, and health status, solving the pain points of difficult equipment supervision and disposal in leasing business, improving the credit rating and transparency of underlying assets, and thereby issuing asset-backed securities to broaden financing channels and reduce funding costs. The interviewed enterprise considered the model "very suitable for our industry, especially equipment-leasing scenarios," and said it can reduce one-time investment pressure when procuring teaching equipment in the future.

Third, infrastructure-oriented enterprises should adopt a "digital special bonds+industry investment alliance" model. Local governments take the lead in issuing special bonds for new infrastructure such as low-altitude take-off/landing sites and low-altitude digital platforms, use big-data technology to measure project returns and visually disclose them to investors, and achieve capital self-balance through "project packaging and benefit sharing." At the same time, an

industry investment alliance jointly participated in by government, state-owned general-aviation groups, and financial institutions is formed to leverage social capital and reduce the funding pressure on a single entity. The interviewed enterprise stated that “special bonds can provide low-cost funds for infrastructure and platform construction, and industry alliances can integrate upstream and downstream resources, reducing enterprise financing difficulty.”

6.2. Bridging the Transformation Channel of "Data Resources—Data Assets—Data Capital"

Data assets are the most distinctive potential financing resource of the low-altitude economy and should form a transformation mechanism from four links. First, in the rights-confirmation link, relying on data-resource registration and blockchain notarization, clarify the holding rights, processing-and-use rights, and operating rights of flight and operation data to provide a legal basis for subsequent financing. Second, in the inclusion link, in accordance with the “Interim Provisions on Accounting Treatment Related to Enterprise Data Resources,” recognize qualifying data resources as intangible assets or inventory so that data value enters financial statements. Third, in the valuation link, establish industry-specific data-asset valuation guidelines, comprehensively adopt the cost, income, and market approaches, and introduce adjustment coefficients such as data quality, scarcity, and application scenarios. Fourth, in the disposal link, cultivate data-asset trading and circulation markets, establish pledge registration and default-disposal rules, so that financial institutions have enforceable relief channels when risks occur. At the same time, enterprises should simultaneously advance data standardization and governance; the interviewed enterprise’s practice of “always doing data standardization” is worth promoting.

6.3. Improving the Risk-Sharing and Policy Instrument System

Given the high-risk and long-cycle characteristics of the low-altitude economy, a multi-level risk-sharing mechanism should be built. First, establish a special low-altitude economy risk-compensation fund to give financial institutions a certain proportion of risk compensation for low-altitude economy loans, enhancing banks’ lending incentives. Second, improve the policy-based guarantee system and expand the coverage and limits of intellectual-property pledges and data-asset pledges. Third, develop specialized insurance products, developing exclusive insurance types around scenarios such as aircraft liability, battery degradation, intellectual-property infringement, and first-of-a-kind equipment application, forming a risk-sharing network connected with credit and leasing. Fourth, optimize the efficiency of fiscal interest subsidies and special bonds, appropriately extending support focus from infrastructure to R&D-and service-oriented enterprises, and improving policy precision.

6.4. Reshaping Risk Control and Credit Enhancement Mechanisms with Digital Technology

Financial institutions should proactively embed digital technology into the entire low-altitude economy credit-granting process. In the customer-acquisition and evaluation stage, use big-data risk control to integrate non-financial information such as order collections, training pre-receipts, operating data, and qualification certifications to build an industry-specific credit-evaluation model for the low-altitude economy. In terms of credit-granting methods, explore a “tiered and classified+active credit-granting” model, changing the passive practice of waiting for enterprise

applications. In data security, use privacy computing to achieve "data available but invisible," completing credit assessment while protecting trade secrets. In post-loan management, rely on IoT and blockchain to continuously monitor asset status and cash flows, reducing post-loan management costs. The interviewed enterprise highly recognized this: "Big data can turn our business data into credit certificates, letting financial institutions understand our operations more clearly; IoT can monitor equipment in real time, reducing the risk of leasing businesses; blockchain can solve the trust problem of data and intellectual property."

6.5. Strengthening Regional Coordination and Institutional Supply

Regarding the regional imbalance, central and western regions should introduce external capital through provincial guidance funds and cross-regional industry alliances, and prioritize special-bond pilots in low-altitude infrastructure and public-service platforms to improve the local industrial ecosystem. Regarding insufficient institutional supply, they should accelerate improving the airspace classification, airworthiness certification, and safety-regulation systems in the low-altitude economy to provide guarantees for asset stability and predictability; simultaneously promote the construction of industry standards and data-interface specifications to reduce cross-institution collaboration costs. In addition, universities should be encouraged to establish low-altitude-economy-related interdisciplinary programs to cultivate compound talents who understand both technology and finance, fundamentally alleviating financial institutions' capacity constraint of "unable to evaluate."

7. Conclusions and Prospects

Against the background of the integrated development of the digital economy and the low-altitude economy, this paper comprehensively uses literature review, policy text analysis, and in-depth enterprise interviews to systematically examine the financing status, dilemmas, and optimization paths of low-altitude economy enterprises. The main conclusions are as follows. First, the financing of low-altitude economy enterprises exhibits a structural feature of "debt-financing dominance, insufficient direct financing, and high policy dependence." Bank credit highly depends on cash flow and compliance qualifications; equity financing is concentrated in leading whole-aircraft enterprises; policy funds focus on infrastructure and equipment manufacturing; and the financing needs of the vast majority of asset-light SMEs have not been effectively met. Second, the causes of financing constraints can be summarized into five aspects: mismatch between asset lightness and traditional collateral logic; mismatch between R&D cycles and credit maturity; lack of rights-confirmation, valuation, and disposal mechanisms for data assets; dual policy and technological uncertainty; and insufficient financial-institution professional capacity and information asymmetry. Among them, the first three are structural contradictions at the asset and technology level, and the latter two are constraints at the institution and capacity level; the two types of factors reinforce each other. Thid, the digital economy provides a practical path to solve the above dilemmas. By constructing tiered and classified financing models of "blockchain+intellectual property securitization," "IoT+leasing ABS," and "digital special bonds+industry investment alliance," bridging the transformation channel of "data

resources—data assets—data capital," and improving risk-sharing through special risk-compensation funds, policy-based guarantees, and exclusive insurance—while reshaping the credit-production mechanism with big-data risk control, privacy computing, and IoT monitoring—financing accessibility of low-altitude economy enterprises can be effectively improved and financing costs reduced without significantly increasing the risk of the financial system.

The limitations of this paper are mainly twofold. First, the number of interview samples is limited; only one typical enterprise was deeply interviewed, and the generalizability of the conclusions needs to be tested by expanding the sample. Second, the cost advantages of innovative financing models lack quantitative measurement; future research can construct a financing-cost measurement model incorporating the risk-free rate, risk premium, and technology-empowerment coefficient to quantitatively compare the efficiency differences between traditional and innovative models. In addition, with the deepening of the data-asset-inclusion accounting system and the improvement of the low-altitude economy regulatory framework, the applicable boundaries of new instruments such as data-asset securitization and RWA tokenization deserve continuous tracking in follow-up research.

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