Decoding US Low-Altitude Economy Policies: Text Mining Based on the TIE Framework

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Abstract

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Abstract:
[Objective] The low-altitude economy represents a strategic frontier leading a new round of global industrial transformation. This study aims to deeply decode the strategic intent, internal structure, and effectiveness of U.S. low-altitude economy policies, providing intelligence support and decision-making references for China to seize the strategic high ground in the low-altitude economy and build an independently controllable policy system. [Methods] This study constructs a three-dimensional analytical framework of "Theme-Instrument-Effectiveness" (TIE), collects 33 U.S. policy texts, and conducts multi-dimensional, mixed-methods policy intelligence analysis using the BERTopic deep learning topic model, policy instrument coding, and the PMC index model. [Conclusions] The policy themes of the U.S. low-altitude economy exhibit typical "technology-driven" characteristics. Its policy instrument configuration displays a structure of "strong hard-environment regulation, robust supply-side promotion, weak demand-side stimulation, and limited innovation empowerment." Overall policy effectiveness is favorable but with individual shortcomings. Based on these findings, the following insights are proposed: The government should make multi-dimensional efforts to guide breakthroughs in core technological bottlenecks and deepen the synergy of innovation systems and ecological development; optimize the dynamic combination of policy instruments to form a balanced implementation and adjustment mechanism integrating rigidity and flexibility; construct a multi-level systematic policy framework to improve the multi-dimensional governance system; and proactively lead international standard cooperation to enhance global rule-making discourse power in the low-altitude economy through multiple pathways.

Keywords: Low-Altitude Economy; Text mining; BERT topic model; Policy tools; PMC index model; the United States

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Preamble

The low-altitude economy, as an emerging and dynamic field, has increasingly become a frontier for economic growth and sustainable social development, driven by innovations in unmanned aerial vehicles (UAVs), electric vertical take-off and landing (eVTOL) technology, and airspace management reform. China's 2024 Government Work Report proposed "actively developing new growth engines such as bio-manufacturing, commercial aerospace, and the low-altitude economy," while the 2025 report emphasized "promoting the safe and healthy development of emerging industries including commercial aerospace, low-altitude economy, and deep-sea technology." The low-altitude economy refers to a comprehensive economic form centered on various manned and unmanned aircraft, driven by various low-altitude flight activities, and radiating to drive integrated development in related fields [1]. As a typical representative of new-quality productive forces, the development of the low-altitude economy requires forward-looking and systematic policy support to create a harmonious ecosystem, stimulate investment vitality, accelerate technology research and development, expand scenario applications, and create social value.

As a developed country, the United States has long introduced numerous policies to promote the low-altitude economy, including laws, regulations, plans, visions, strategies, white papers, and guidelines, such as the Federal Aviation Administration' s *Federal Aviation Regulations*, the U.S. Congress' s *Airport, Terminal Safety and Capacity Expansion Act*, and the *General Aviation Revitalization Act*. In recent years, China has issued the *National Comprehensive Three-Dimensional Transportation Network Planning Outline*, the *Unmanned Aircraft Flight Management Regulations*, and the *General Aviation Equipment Innovation and Application Implementation Plan (2024-2030)*, and established the General Aviation and Low-Altitude Economy Work Leading Group in 2025. However, compared with the United States, China' s low-altitude economy started relatively late and remains in the exploratory stage regarding regulations, airspace management, and technology application. In practice, significant gaps exist in infrastructure network layout, independent and controllable industrial chains, professional talent reserves, and commercialization models. An overall low-altitude policy system has yet to be formed, requiring comprehensive breakthroughs and improvements.

This study collects U.S. low-altitude economic policy texts to decode their core, extract experiences, adopt the essence and discard the dross, and provide insights for China' s policy development, cultivating new-quality productive forces and promoting high-quality development of the low-altitude economy.

Literature Review

Current academic research on low-altitude economic policies presents multi-dimensional characteristics. From an international perspective, research focuses on Urban Air Mobility (UAM) as the core carrier of the low-altitude economy, covering three dimensions: intelligent technology, system solutions, and application scenarios. Specifically, although Intelligent Technology (IT) serves as a key driver for UAM, it faces technical bottlenecks such as battery degradation, noise pollution, and privacy security [2,3]. System solutions emphasize the collaborative mechanism between eVTOL and digital air traffic management systems, with Hamburg Airport in Germany having completed feasibility verification [4]. Airspace hierarchical management or infrastructure transformation is considered a solution path [5,6]. Application scenarios range from public medical transport to private logistics, with vertiport location layout receiving significant academic attention [7,8], though systematic policy analysis in existing research remains to be deepened.

Domestic research mainly includes two categories: introduction of foreign policies and analysis of local policies. Regarding foreign policy research, Xu Shilin pointed out that the U.S. Federal Aviation Administration undertakes the function of standards and regulations formulation and implementation [9]; Liao Huijiao explored the U.S. drone regulatory system [10], though the breadth and methodological depth of overall policy analysis need expansion. Local policy research is further refined into: First, research on cross-domain policy coordination mechanisms. Hu Yang used AHP to explore the supporting role of local policy and air traffic management system synergy in low-altitude economic development, using Nanchang Changbei Airport as an example [11]; Kong Dejian and Yuan Ze proposed coordination paths at the policy and legal level [12]; Zhang Yujie constructed a legal guarantee framework from a legal policy perspective [13]; Chen Yong et al. focused on UAV communication spectrum management policies [14]; Meng Xianmin et al. analyzed industrial support policies [15]; and Wang Yanping et al. explored the enabling effect of fiscal policies [16]. Second, regional practice and text quantitative research. At the regional level, Huang Qiaolong et al. discussed Fujian' s industrial policies [17]; Chen Yu et al. conducted comparative analysis of key provinces and cities [18]; Wei Yongtao proposed suggestions for low-altitude logistics policies in border areas [19]; Wang Shitai et al. analyzed AI empowerment paths based on Guangdong and Jiangsu policy texts [20]; Liang Lizhi et al. analyzed low-altitude economic policy texts using a "Goal-Instrument-Actor" three-dimensional framework [21]; Shao Peng et al. revealed the text characteristics of super-large and mega-city low-altitude economic policies and their driving effect on application scenario innovation [22]; Zhang Xin [23], Wang Chengcheng et al. [24], and Xu Pengfei et al. [25] respectively used the PMC index model to analyze policy samples; Zhang Cuiyun [26] and Lin Yanli et al. [27] proposed specific provincial policy optimization suggestions for Hebei and Liaoning. Third, research on specific domain applications. He Yong et al. discussed the adaptability of low-altitude economic policies and technologies in agricultural and rural scenarios [28]; Zhang Hui introduced narrative policy frameworks to optimize social cognition of the low-altitude economy [29]. Fourth, research on sustainable development orientation. Mao Lei [30] and Jiang Hui and Zhang Huiheng [31] respectively proposed policy optimization paths from the perspectives of industrial sustainability and overall development.

In summary, existing research provides useful perspectives for understanding low-altitude economic policies, but significant limitations remain: First, most content focuses on local issues or internal national policies, with few cross-dimensional decodings of powerful nations' low-altitude economic policies. Second, methods mostly adopt content analysis or quantitative statistics, with few applying deep text mining methods, making it difficult to support strategic-level intelligence insights. Therefore, this study collects texts and applies text mining to analyze U.S. low-altitude economic policies—one of the powerful nations in this domain—from the dimensions of policy themes, policy instruments, and policy effectiveness, aiming to provide references for China' s low-altitude economic policy formulation and improvement.

Methodology

3.1 Research Methods and Basic Approach

The research follows the logic of "data collection → multi-dimensional analysis → conclusions and implications." First, manual segmentation ensures each English text data entry contains $ $512 tokens, and the NLTK tokenization library is used to segment texts while setting stop words to remove invalid information. Second, the BERT deep learning model is employed following the path of "text high-dimensional vectorization → UMAP algorithm dimensionality reduction → K-means algorithm clustering → TF-IDF algorithm keyword extraction" to obtain text topics, keywords, and visualization results for policy theme analysis. Third, the Nvivo15 qualitative research tool is used to encode text content and statistically analyze policy instrument usage. Then, the PMC index model is utilized to analyze the effectiveness of U.S. low-altitude economic policy texts. Finally, based on the characteristics of U.S. low-altitude economic policies, recommendations for China' s low-altitude policy formulation and optimization are proposed. The research framework is shown in Figure 1

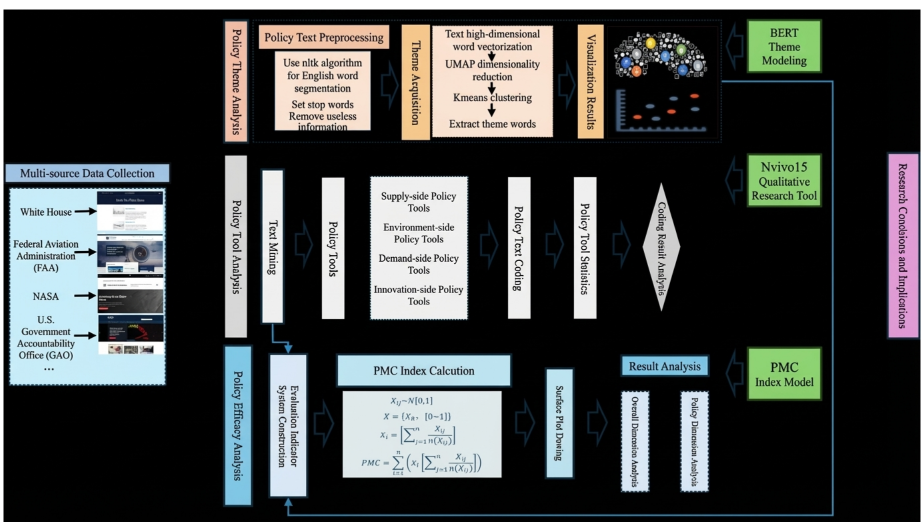

Figure 1: Figure 1

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3.2 Data Sources and Preprocessing

Figure 1 Research Framework

Table 1 Research Samples

1. *Federal Aviation Regulations*
2. *Airport and Airway Improvement Act*
3. *Airport and Terminal Safety and Capacity Expansion Act*
4. *The General Aviation Revitalization Act*
5. *The Wendell H. Ford Aviation Investment and Reform Act for the 21st Century*
6. *Aviation & Transportation Security Act*
7. *FAA Modernization and Reform Act of 2012*
8. *Unmanned Aerial System (UAS) Traffic Management (UTM): Enabling Low Altitude Airspace and UAS Operations*
9. *Small UAS Flight Plan 2016-2036*
10. *Study Guide for Remote Pilots - Small Unmanned Aerial Systems*
11. *FAA Extension, Safety, and Security Act of 2016*
12. *Unmanned Aircraft System Integration Pilot Program*
13. *21st century Aviation Innovation, Reform, and Reauthorization Act*
14. *Drone Aircraft Privacy and Transparency Act of 2017*
15. *Safe Drone Act of 2017*
16. *FAA Reauthorization Act* (2018)
17. *National Plan of Integrated Airport Systems 2019-2023*
18. *Urban Air Mobility (UAM) Vision*
19. *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap*
20. *Unmanned Aircraft Systems: Current Jurisdictional, Property, and Privacy Legal Issues Regarding the Commercial and Recreational Use of Drones*
21. *Remote Identification of Unmanned Aircraft*
22. *Advanced Air Mobility Coordination and Leadership Act*
23. *Advanced Aviation Infrastructure Modernization Act*
24. *Engineering Brief 105 for Vertiport Design*
25. *Planning for advanced air mobility*
26. *NATIONAL AERONAUTICS SCIENCE & TECHNOLOGY PRIORITIES*
27. *Urban Air Mobility (UAM) Version 2.0 Concept of Operations*
28. *Advanced Air Mobility (AAM) Implementation Plan*
29. *Law Enforcement and Technology: Use of Unmanned Aircraft Systems*
30. *FAA Reauthorization Act* (2023)
31. *Air Traffic and General Operating Rules*
32. *Unleashing American Drone Dominance*
33. *Restoring American Airspace Sovereignty*

Results

4.1 Policy Theme Analysis

Policy themes are key to understanding national strategic intent. Using Visual Studio Code (Version: 1.96.3), this study employs the SentenceTransformer all-MiniLM-L6-v2 sub-model to generate 384-dimensional word vectors, utilizes the UMAP algorithm for dimensionality reduction, and applies K-means algorithm with preset clustering to generate 15 topics. The final visualization results include a topic heatmap (Figure 2a

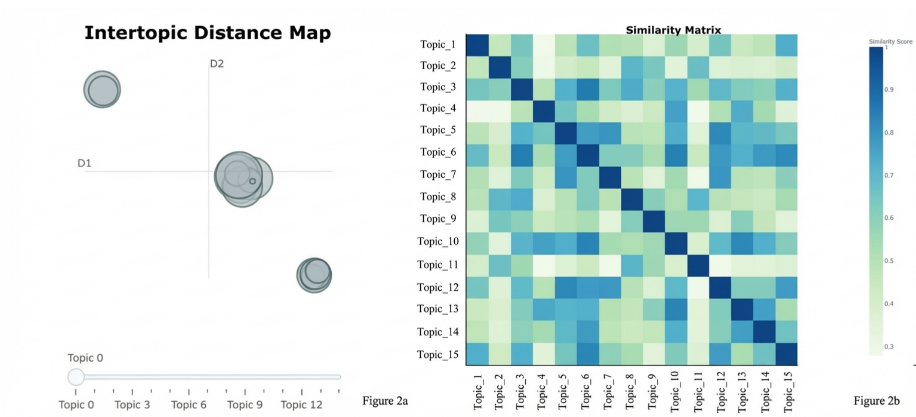

Figure 2: Figure 2

), topic distance map (Figure 2b), and topic clustering diagram (Figure 3a [FIGURE:3]), enabling thematic analysis of U.S. low-altitude economic policy texts.

The topic distance map displays topic distribution in a two-dimensional plane through dimensionality reduction, where circle size indicates relative topic importance and smaller inter-topic distances indicate higher semantic similarity. The topic heatmap shows pairwise topic similarity relationships, with darker colors indicating stronger semantic correlation and lighter colors indicating weaker correlation. As shown in Figures 2a and 2b, topic nodes are compactly distributed with small spacing, indicating high inter-topic correlation and internal logical consistency. Color blocks correspond to inter-topic relationships, with both visualization results jointly validating the scientific validity of topic clustering.

Figure 2 Topic Distance Map (Figure 2a) and Topic Heatmap (Figure 2b)

To excavate key policy content, referencing existing research by Xu Pengfei et al. [25], a word cloud (Figure 3b) was generated based on word frequency statistics, and the top 100 keywords are presented in Table 2 . The data reveal that U.S. low-altitude economic policies exhibit significant technology-driven characteristics, aiming to consolidate and strengthen U.S. dominance in global low-altitude economic technology. The policy system is structurally divided into three core dimensions:

First, U.S. low-altitude economic policies follow a safety-first underlying logic. High-frequency keywords such as "safety," "requirement," "limitation," "control," and "compliance" reflect a strict governance framework centered on risk prevention and compliance requirements. This system relies on regulatory instruments like "rule" and "regulation" to construct a closed-loop regulatory chain throughout the industrial chain, clarifying legal responsibilities and behavioral red lines for government, enterprises, and participants to ensure technological applications and industrial development do not breach safety baselines.

Second, U.S. low-altitude economic policies focus on technology research and development and innovation ecosystem cultivation. High-frequency terms such as "uas," "unmanned," "remote," "identification," "engine," "design," and "data" reflect comprehensive U.S. layout in key technology areas including unmanned aerial systems, power devices, intelligent identification, and data governance. Policies promote overall leaps in hardware innovation, system integration, and information control capabilities through direct R&D support or indirect market demand guidance mechanisms, strengthening the international competitiveness of its industrial ecosystem.

Third, U.S. low-altitude economic policies embody a vertical collaborative governance mechanism of "federal coordination and local adaptation." Institutional terms such as "faa," "federal," and "agency," along with hierarchical terms like "government," "local," and "community," indicate that policy implementation emphasizes framework legislation and bottom-line constraints at the federal level while granting certain adaptation authority to local governments and communities. This mechanism, through dynamic revision and multi-party participation, avoids policy rigidity while preventing "fragmentation" in policy execution, stimulating regional innovation enthusiasm while ensuring national airspace security.

In summary, U.S. low-altitude economic policies construct an institutional system supporting sustainable low-altitude industry development through three pillars of safety regulation, technology promotion, and collaborative governance, demonstrating significant strategic orientation and technological hegemony characteristics in global low-altitude economic competition.

Table 2 Top 100 Words by Frequency

aircraft engine landing ground community operation requirement administrat identificat federal aviation unmanned remote airport flight limitation control condition public program pilot airplan complia airspac standar power person design operato regulat agency technology administratio enactment development passenger secretary the united states speed government equipment emergency individual commente analysis component committe industry carrier process policy enforcement operatio authorit rotorcra performa security infrastruct department stakeholder force commercial altitude management procedur potential facility training structure congress safety transportat service amended nationa provision local applicable capabili conduct position device traffic property

4.2 Policy Instrument Analysis

Policy instruments are key means for governments to translate policy goals into practice [33]. Synergistic policy instrument combinations can effectively achieve objectives, and systematic analysis of policy instrument composition and linkage mechanisms can provide a basis for optimizing policy systems. Scholars have various classification methods for policy instruments. Given that the low-altitude economy is an emerging economic form and the *General Aviation Equipment Innovation and Application Implementation Plan (2024-2030)* emphasizes innovative products and service models, this study builds upon Rothwell and Zegveld' s policy instrument theory [34], combined with policy text mining and research by scholars such as Mao Zijun et al. [35-40]. Based on supply-side, environmental, and demand-side policy instruments, this study specifically adds innovative policy instruments and, following the logic of "from micro products to macro industry," divides innovative policy instruments into four types: product innovation, service innovation, model innovation, and format innovation, forming 19 specific low-altitude economic policy instruments as shown in Table 3 .

Table 3 Policy Instrument Types, Names, and Connotations

Type	Name	Connotation
Supply-side	Infrastructure Construction (IC)	Planning and constructing general airports, airspace management systems, takeoff and landing points, and other physical hardware facilities, as well as supporting air traffic management software and communication networks, to provide physical space and carrier support for low-altitude flight activities.
	Technology R&D Support (TRS)	Establishing special research programs, encouraging industry-university-research cooperation, and promoting R&D of key low-altitude technologies.

Type	Name	Connotation
	Financial Support (FS)	Providing direct financial investment through fiscal appropriations and special funds to supply start-up, R&D, and operational stage capital for low-altitude economy enterprises, alleviating their phased funding pressure.
	Talent Training and Introduction (TTI)	Systematically educating and training to enhance talent capabilities while externally introducing high-quality talents with professional skills and innovative qualities to optimize talent structure and enhance competitiveness.
	Public Services (PS)	Government provision of comprehensive services covering low-altitude traffic data sharing platforms, general aviation technical standard consulting, and industry information release to help enterprises solve information asymmetry and resource dispersion problems and support industrial collaborative development.
Environmental	Laws and Regulations (LR)	Formulating or revising low-altitude flight legal norms, clarifying legal relationships such as airspace usage rights, flight approval processes, and accident liability definitions, and delineating industrial behavior boundaries.
	Standards and Norms (SN)	Formulating specific technical standards for low-altitude aircraft design, manufacturing, and operation regarding technical performance, quality testing, and safe operation to provide unified implementation scales.
	Supervision and Management (SM)	Ensuring legal and compliant low-altitude operations through real-time monitoring, regular inspections, and violation penalties.

Type	Name	Connotation
	Financial Tax Incentives (FTI)	Reducing enterprise operating costs and guiding resources toward environmentally friendly and efficient fields through economic means such as tax reductions and low-interest or interest-free loans.
	Communication and Coordination (CC)	Building cross-department information sharing platforms and establishing collaborative consultation mechanisms with enterprise, research institution, and customer representative participation to coordinate and resolve cross-domain contradictions and promote multi-party interest consensus.
Demand-side	Government Procurement (GP)	Creating market demand and assisting industrial development through government priority procurement of services such as inspection drones and emergency rescue flights.
	Demonstration Projects (DP)	Playing a leading role and promoting industrial agglomeration through government investment in leading low-altitude economy-related projects such as general airports and air traffic demonstration routes.
	Market Cultivation (MC)	Stimulating market demand in the low-altitude economy field and promoting user cognition enhancement and consumption habit formation through consumption subsidy policies and industry promotion activities.
	Scenario Promotion (SP)	Exploring "low-altitude+" scenarios such as low-altitude tourism, logistics distribution, and emergency rescue, and enhancing social cognition and acceptance through pilot programs.
	International Cooperation (ICo)	Promoting domestic enterprises' integration into the global industrial chain through cross-border technology exchange, project cooperation, and technology introduction.

Type	Name	Connotation
Innovative	Product Innovation (PI)	Encouraging enterprises to increase technology R&D and create products with new performance and new uses.
	Service Innovation (SI)	Encouraging enterprises or institutions to optimize service processes, expand quality and capacity, and provide high-quality, efficient, and personalized services.
	Model Innovation (MI)	Supporting enterprises to reconstruct business models, optimize operational processes, and innovate profit logic to enhance industrial efficiency and user value.
	Format Innovation (FI)	Breaking through traditional industrial boundaries, forming new industrial organization forms and business formats, and promoting industrial upgrading.

(1) Policy Text Encoding

Using the Nvivo15 qualitative research tool, the content of 33 low-altitude economic policy texts was sequentially read and encoded. The same policy instrument in the same policy was only counted once, recorded according to "policy number-chapter number-clause number." Partial encoding unit examples are shown in Table 4 .

Table 4 Policy Text Content Unit Encoding Examples

Encoding Unit	Policy Text Content
1-I-101	airport construction and improvement projects which increase the capacity of facilities···
2-II-203	ASSURE established a UAS STEM education program to inspire minority and underserved middle and high school youth throughout the US to pursue scientific degrees and careers···
3-I-105	Enact laws and regulations for governing UAM operations, such as zoning, privacy, and noise, striving for consistency across operating locations···

Encoding Unit	Policy Text Content
4-II-208	AIRCRAFT CERTIFICATION PERFORMANCE OBJECTIVES AND METRICS···
5-I-112	Unmanned Aerial Systems (UAS) have been imagined ranging from remote to congested urban areas, including goods delivery, infrastructure surveillance, agricultural support···
6-I-137	The U.S. Government will work with ICAO and other international organizations to develop cost-effective, cooperative international···
7-II-211	H.R. 2997 would establish a federally chartered, not-for-profit corporation (known as the American Air Navigation Services (AANS) Corporation) to assume responsibility for operating the U.S. air traffic control system, a function currently performed by the Federal Aviation Administration (FAA)···
8-I-102	acceleration of research, development, testing, and evaluation of new screening technology for carry-on items to provide more effective means of detecting and identifying weapons, explosives, and components of weapons of mass destruction, including···

(2) Encoding Results Analysis

After encoding and statistical summary, 198 policy instrument reference points were obtained, as shown in Figure 4

. Among them, supply-side policy instruments account for 30.81%, environmental policy instruments for 45.96%, demand-side policy instruments for 16.16%, and innovative policy instruments for 7.07%. Environmental policy instruments approach nearly half of the total, supply-side instruments rank second, demand-side instruments account for less than half of environmental instruments, and innovative instruments have the lowest frequency, presenting an overall distribution pattern of "hard environmental regulation, strong supply-side promotion, weak demand-side stimulation, and limited innovation empowerment." This aligns with the theme analysis results, focusing on building a safe and healthy development environment and technical supply support while considering demand and innovation.

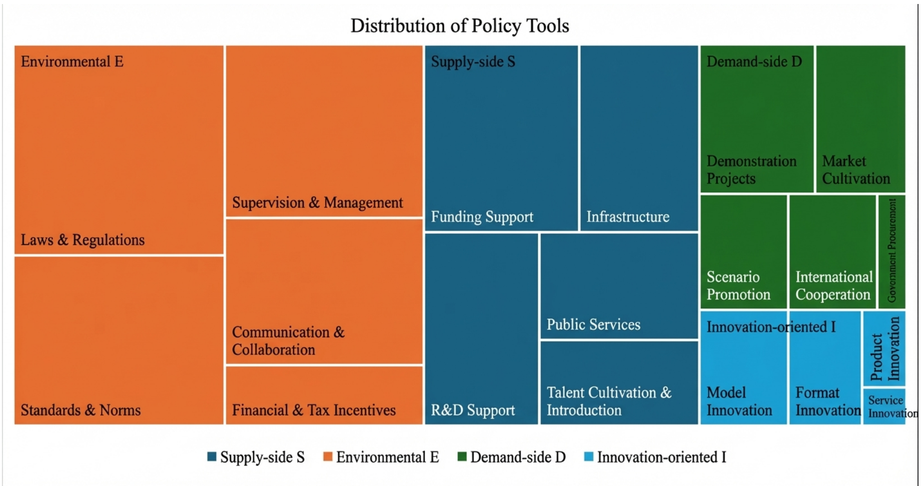

Figure 3: Figure 4

Supply-side Policy Instruments. In infrastructure, the U.S. has built a hardware support system centered on vertiports. *Engineering Brief 105 for Vertiport Design* explicitly specifies technical standards for eVTOL dedicated takeoff and landing areas, including Touch Down and Lift Off Area (TLOF), Final Approach and Takeoff Area (FATO), and dimensional specifications for safety areas, while proposing specific requirements for supporting infrastructure such as Charging and Electric Infrastructure (CEI) and Automated Weather Observing System (AWOS). The U.S. federal government also established a special pilot program through the *Advanced Aviation Infrastructure Modernization Act*, allocating a $5 billion budget for Vertiport network construction in cities like Dallas-Fort Worth, focusing on supporting charging facility integration and low-altitude traffic management system upgrades. In technology R&D support, NASA collaborates with Joby Aviation to advance eVTOL system R&D such as Distributed Electric Propulsion, Autonomous Flight Technology, and Modular Architecture. In financial support, the government directly provides development funds through fiscal budget appropriations, and enterprises participating in the low-altitude economy enjoy 150% R&D expense super-deduction, directly reducing enterprise innovation costs. In talent training and introduction, universities such as Caltech have established "low-altitude mobility special programs" to cultivate compound talents with UAV management and eVTOL operation capabilities, forming a direct supply chain of "R&D-infrastructure-talent." In public services, the *FAA Reauthorization Act* (2018) mentions optimizing Wi-Fi, GPS and other infrastructure to create "a more consumer-friendly and digitally connected airport experience."

Environmental Policy Instruments. In laws and regulations, the U.S. federal-state-industry three-level legislative system uses federal-led systematic legislation to clarify airport development and safety supervision while allowing states to adapt measures to local conditions and form collaborative governance with industry self-discipline, explicitly stipulating airport planning, development, fund usage, safety supervision and other aspects, such as SEC.111.AIRPORT PLANNING AND DEVELOPMENT AND NOISE COMPATIBILITY PLANNING AND PROGRAMS in the *FAA Reauthorization Act* (2018). In standards and norms, unified and technologically forward-looking national standards are formulated from aircraft design to airport services, covering safety, environmental protection, and emerging fields like UAVs. The "FAA SAFETY CERTIFICATION REFORM" section of the *FAA Reauthorization Act* (2018) establishes a series of standards and norms for aircraft certification and flight standards to ensure aircraft safety and airworthiness, while "Airport Noise and Environmental Streamlining" and "Unmanned Aircraft Systems" sections provide detailed specifications for airport noise and environmental issues and UAV operation norms and safety standards. In supervision and management, policy clauses clarify regulatory boundaries, compliance assessments, and penalty mechanisms, providing a controllable environment for low-altitude economy-related field development while ensuring aviation safety. In financial tax incentives, the *Airport and Terminal Safety and Capacity Expansion Act* explicitly provides tax exemption policies for participating in specific emergency medical transport, and the *FAA Reauthorization Act* (2018) also uses trust fund mechanisms to extend aviation fuel taxes, providing financial support for the aviation field. In communication and coordination, the federal level attaches importance to unified standard formulation and inter-departmental communication, such as SEC.383.AIRPORT SAFETY AND AIRSPACE HAZARD MITIGATION AND ENFORCEMENT requiring FAA cooperation with the Department of Defense, Department of Homeland Security and other federal departments or agencies to detect and mitigate potential UAV system risks to airport operations, effectively ensuring top-level consistency and coordination and avoiding functional overlap or conflict.

Demand-side Policy Instruments. Government procurement is relatively limited, indicating that the federal government has fewer policy-level provisions for purchasing low-altitude economy products or services. In demonstration projects, the *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap* explicitly mentions the UAS Integration Pilot Program (IPP), and *Unleashing American Drone Dominance* Article 6 establishes the eVTOL Integration Pilot Program (eIPP) as an extension of the BEYOND program. In market cultivation, the *NATIONAL AERONAUTICS SCIENCE & TECHNOLOGY PRIORITIES* white paper mentions that the U.S. federal government actively opens advanced air mobility (AAM) development paths, providing a fresh and exciting new community travel option. According to *Unmanned Aircraft Systems: Current Jurisdictional, Property, and Privacy Legal Issues Regarding the Commercial and Recreational Use of Drones*, the FAA has approved multiple commercial enterprises to conduct UAV delivery businesses and issues type certificates for corresponding delivery UAVs based on gradually improved certification standards, while the U.S. Postal Service has explored the possibility of using UAVs for package and mail delivery. In scenario promotion, *Unmanned Aerial System (UAS) Traffic Management (UTM): Enabling Low Altitude Airspace and UAS Operations* mentions UAS applications including cargo delivery and infrastructure monitoring, covering agriculture and medical fields. The *National Plan of Integrated Airport Systems (2019-2023)* involves aerial applications such as emergency medical services, agricultural fertilization, and forest firefighting, and emphasizes aerial observation applications for pipelines or electrical grid infrastructure. In international cooperation, the U.S. has established the "North American Low-Altitude Corridor" with Canada and Mexico to simplify cross-border approval processes. The white paper mentions that the U.S. government will cooperate with ICAO and other international organizations to develop cost-effective, cooperative international standards and supervision methods.

Figure 4 Low-Altitude Economic Policy Instrument Statistics

Innovative Policy Instruments. The U.S. federal government allows enterprises to pilot disruptive business models: Joby Aviation' s "membership commuter service" launches monthly flight packages, supporting the development of the Airmap real-time airspace planning platform integrating meteorological data and flight approval systems, forming a hardware-software fusion ecosystem. In product innovation, the federal government funds eVTOL R&D projects, including Lilium Aviation' s seven-seat eVTOL achieving 300 km range. In service innovation, U.S. PSU (Providers of Services to UAM) provides personalized services such as route planning, traffic conflict resolution, plan adjustment, and information services, though overall policy involvement in service innovation is limited. In model innovation, exploring "aerial sharing economy" uses blockchain technology to enable private eVTOL shared access, where flight credit points can be exchanged for ground transportation services, offering considerable future development prospects but limited current popularity. *Planning for advanced air mobility* explicitly mentions distributed operations with electric propulsion as the main body, intelligent scheduling through NASA' s AAM-CIP digital platform, and AAM integration of ticket-to-baggage-check processes through the "Mobility as a Service (MAAS)" platform to achieve "one-click" travel. In format innovation, the development of UAV technology, intelligent sensors, and artificial intelligence has spawned the low-altitude data service industry, and the integration of UAV logistics, urban transportation, and energy infrastructure is breaking traditional aviation industry boundaries. However, overall innovative policy instrument usage remains low.

4.3 Policy Effectiveness Analysis

Policy effectiveness refers to the potential capacity of policy texts to achieve policy goals through instrument design, goal setting, and implementation mechanisms. This study uses the PMC index model proposed by Ruiz Estrada

[41] for policy effectiveness evaluation to comprehensively, systematically, and objectively quantify various policy aspects, achieving unified judgment of policy consistency and reduced evaluation subjectivity [42], and enabling multi-dimensional comparison of policy focus areas and weak links [43].

(1) Constructing the Evaluation Index System

Index Selection and Parameter Setting

Using BERTopic can improve the PMC index model' s precision in quantitative evaluation of government policies [44]. Therefore, based on text mining and policy theme analysis, combined with research by scholars such as Zhang Yong' an and Qie Haituo [45] and Zhang Xi et al. [46], this study ultimately selects 9 primary variables (divided into policy content and policy process dimensions) and 37 secondary variables for the low-altitude economic policy effectiveness evaluation index system (see Table 5). Simultaneously, a binary approach is adopted, assigning a value of 1 when policy text content involves secondary variables and 0 otherwise, to ensure consistent weighting of secondary variables. For X4 Policy Actor, independence—whether independently issued by an authoritative body—is counted as 1 if satisfied, otherwise 0; jointness—whether jointly issued by two or more agencies—is counted as 1 if yes, otherwise 0. For X6 Effectiveness Level, since low-altitude economy requires strong regulation to ensure safety, this study adopts a stepwise decreasing assignment method based on research by Zhu Xiaofeng et al. [44] and Zhang Xi et al. [46]. Specifically, "laws and administrative regulations" (laws, regulations, mandatory orders) are assigned 1, indicating the highest authority and importance; "departmental rules" (provisions, rules, regulations), "normative documents" (strategies, plans, guidelines, schemes, programs, engineering briefs, white papers), and "industry regulations" (visions, roadmaps, blueprints) are assigned 0.75, 0.50, and 0.25 respectively.

Table 5 Low-Altitude Economic Policy Evaluation System

Primary Variable	Secondary Variable	Evaluation Standard	Value Range	Source/Reference
X1 Policy Nature	X1.1 Prediction	Whether predictive in nature	X1.1~N [0,1]	Reference Zhang Yong' an & Qie Haituo [45]
	X1.2 Recommendation	Whether recommendatory in nature	X1.2~N [0,1]	
	X1.3 Supervision	Whether supervisory in nature	X1.3~N [0,1]	

Primary Variable	Secondary Variable	Evaluation Standard	Value Range	Source/Reference
	X1.4 Description	Whether descriptive in nature	X1.4~N [0,1]	
	X1.5 Guidance	Whether guiding in nature	X1.5~N [0,1]	
	X1.6 Support	Whether supportive in nature	X1.6~N [0,1]	
X2 Policy Timeliness	X2.1 Short-term (1-3 years)	Whether short-term content involved	X2.1~N [0,1]	Reference M.A.Ruiz Estrada [41] modified
	X2.2 Medium-term (3-5 years)	Whether medium-term content involved	X2.2~N [0,1]	
	X2.3 Long-term (>5 years)	Whether long-term content involved	X2.3~N [0,1]	
X3 Policy Domain	X3.1 Political	Whether political domain involved	X3.1~N [0,1]	Reference Zhang Xi et al. [46]
	X3.2 Economic	Whether economic domain involved	X3.2~N [0,1]	
	X3.3 Social	Whether social domain involved	X3.3~N [0,1]	
	X3.4 Environmental	Whether environmental domain involved	X3.4~N [0,1]	
	X3.5 Technological	Whether technological domain involved	X3.5~N [0,1]	
	X3.6 Cultural	Whether cultural domain involved	X3.6~N [0,1]	

Primary Variable	Secondary Variable	Evaluation Standard	Value Range	Source/Reference
X4 Policy Actor	X4.1 Independence	Whether authoritative and independent	X4.1~N [0,1]	Reference Zou Kai et al. [47]
	X4.2 Jointness	Whether diverse actors jointly issued	X4.2~N [0,1]	
X5 Policy Target	X5.1 Government	Whether government is target	X5.1~N [0,1]	Reference Mao Taitian et al. [43], Chen Qiang et al. [48]
	X5.2 Enterprise	Whether enterprise is target	X5.2~N [0,1]	
	X5.3 Public	Whether public is target	X5.3~N [0,1]	
	X5.4 University	Whether university is target	X5.4~N [0,1]	
	X5.5 Research Institution	Whether research institution is target	X5.5~N [0,1]	
X6 Effectiveness Level	X6.1 Laws & Administrative Regulations	Laws, regulations, mandatory orders	X6.1~N [0,1]	Reference Zhu Xiaofeng et al. [44], Zhang Xi et al. [46] modified
	X6.2 Departmental Rules	Provisions, rules, regulations	X6.2~N [0,1]	
	X6.3 Normative Documents	Administrative orders, strategies, plans, guidelines, schemes, programs, engineering briefs, white papers	X6.3~N [0,1]	

Primary Variable	Secondary Variable	Evaluation Standard	Value Range	Source/Reference
	X6.4 Industry Regulations	Visions, roadmaps, blueprints	X6.4~N [0,1]	
X7 Policy Goal	X7.1 Promote Tech Innovation	Whether goal is to promote technological innovation and capability improvement	X7.1~N [0,1]	Based on text mining
	X7.2 Promote Industrial Upgrading	Whether goal is to promote industrial upgrading and scale expansion	X7.2~N [0,1]	
	X7.3 Ensure Flight Safety	Whether goal is to ensure flight safety and management	X7.3~N [0,1]	
	X7.4 Cultivate Commercial Application	Whether goal is to cultivate commercial application and market	X7.4~N [0,1]	
X8 Policy Theme	X8.1 Aviation Safety & Operation	Whether theme involves aviation safety and operation management	X8.1~N [0,1]	Based on text mining
	X8.2 UAV Industry Development	Whether theme involves UAV industry development and innovation	X8.2~N [0,1]	
	X8.3 Regulation & Compliance	Whether theme involves regulation supervision and compliance execution	X8.3~N [0,1]	

Primary Variable	Secondary Variable	Evaluation Standard	Value Range	Source/Reference
X9 Policy Evaluation	X9.1 Well-Founded	Whether well-founded	X9.1~N [0,1]	Based on text mining and reference Huo Chaoguang [49], Zhang Shaofeng et al. [50] modified
	X9.2 Clear Objectives	Whether objectives are clear	X9.2~N [0,1]	
	X9.3 Detailed Content	Whether content is detailed	X9.3~N [0,1]	
	X9.4 Scientific Scheme	Whether scheme is scientific	X9.4~N [0,1]	

PMC Index Calculation

Following existing research [43-46], the PMC index is calculated. Specific steps are: First, construct a multi-input-output table covering primary and secondary variables. Second, assign values to secondary variables according to Formula 1 and Formula 2, where i represents primary variables and j represents secondary variables. Third, calculate each primary variable indicator score according to Formula 3, where n represents the number of secondary variables under primary variables. Finally, calculate each policy' s PMC value according to Formula 4 and evaluate corresponding low-altitude economic policies based on numerical values. The rating standards are shown in Table 6 .

Following the above steps, the final policy scores, ratings, and rankings are obtained as shown in Table 7 .

Table 6 Policy Evaluation Rating Classification Standards

PMC Index	Rating
0~4.99	Poor
5.00~5.99	Acceptable
6.00~6.99	Good
7.00~7.99	Excellent
8.00~9.00	Perfect

Table 7 PMC Index Calculation Results Summary

(Table content not fully provided in original text)

PMC Surface Map Drawing

Based on PMC index calculation results, surface maps are constructed to visually display each evaluation indicator' s score. According to Table 7 data, using Python 3.12.10 (Pycharm 2025.1.2) and Formula 5, PMC surface maps for 33 low-altitude economic policies were obtained, with partial examples shown in Figure 5 [FIGURE:5].

Figure 5 Example of Low-Altitude Economic Policy PMC Surface Map

(2) U.S. Low-Altitude Economic Policy Text Evaluation Results Analysis

Overall Dimension Analysis

PMC index calculation results show that among 33 U.S. low-altitude economic policy texts, all rating levels are represented. Specifically, 1 policy is rated as poor, 6 as acceptable, 9 as good, 13 as excellent, and only 4 as perfect. Overall, policies rated good, excellent, and perfect account for over 70%, indicating that U.S. low-altitude economic policy formulation considers various indicators or factors relatively comprehensively, possessing high rationality and completeness. Meanwhile, the mean score of 33 policies is 6.83, reaching the good rating standard, indicating the U.S. attaches high importance to and actively promotes low-altitude domain economic development.

Policy Dimension Analysis

Policy dimension analysis includes policy content and policy process dimensions, specifically generated using Python 3.12.10 (Pycharm 2025.1.2) as shown in Figure 6 [FIGURE:6].

Policy Content Dimension. The vast majority of policies score high on policy nature (X1), focusing mainly on supervision, description, guidance, and support, with less involvement in prediction and recommendation. This indicates that U.S. low-altitude economic policy formulation emphasizes overall stability, pragmatism, and interest balance. This characteristic not only provides certain trial-and-error space for the industry but also facilitates response to systemic risks, though it lacks certain forward-looking vision. Effectiveness level (X6) scores are relatively high, with X6.1 laws and administrative regulations accounting for 14 items, X6.2 departmental rules for 3 items, X6.3 normative documents for 14 items, and X6.4 industry regulations for 2 items. This indicates that U.S. low-altitude economic policies are dominated by federal laws and administrative regulations, supplemented by numerous normative documents for detailed implementation, while departmental rules and industry regulations occupy smaller shares. Although the U.S. federal government centrally controls and rapidly responds to technical needs through flexible administrative means, industry autonomy and systematic legislation still require strengthening. Policy goals (X7) score high, indicating the U.S. attaches great importance to low-altitude technology innovation, industrial development, safety management, and commercial markets. Policy themes (X8) also score high, indicating U.S. policy formulation balances risk prevention, growth drivers, and governance effectiveness, striving to achieve a triangular balance of safety baseline, industrial momentum, and institutional guarantee.

Figure 6 Low-Altitude Economic Policy Evaluation Indicator Results

Policy Process Dimension. Policy timeliness (X2) scores high, indicating most U.S. low-altitude economic policies integrate short-term plans and long-term actions, enabling timely response while maintaining strategic thinking and strong coherence. Policy targets (X5) also score high, with an average score of 0.76, indicating the U.S. possesses relatively professional decision-making mechanisms, efficient cross-departmental coordination, and multi-actor collaborative capabilities. Policy evaluation (X9) scores highest, indicating strong scientific policy formulation that conforms to reality and provides substantial execution space.

However, policy domain (X3) scores low, specifically showing more involvement in economic, social, environmental, and technological domains but less in political and cultural domains. This reflects that U.S. policies tend to solve practical problems through technical standards and market mechanisms rather than political consultation and cultural integration, potentially neglecting governance system adaptability (such as backward airspace management systems) and sociocultural impacts (such as low public acceptance) in policy formulation. Meanwhile, policy actors (X4) also score low, with policies mainly issued by single departments or administrative agencies and less by multiple departments, reflecting weak U.S. cross-departmental collaborative governance that is not conducive to comprehensive policy consideration.

Conclusions and Implications

5.1 Research Conclusions

Following the "Theme-Instrument-Effectiveness" framework and employing topic modeling, text mining, and index models, this study examines the structural characteristics and textual effectiveness of U.S. low-altitude economic policies, reaching the following conclusions:

First, policy themes are centered on "technology-driven" characteristics with high diversity. U.S. policy themes are widely and densely distributed, covering key areas such as aircraft technical standards, low-altitude flight vehicle development, and operational safety assurance. Keywords like "aircraft," "uas," and "technology" appear with high frequency. The collaborative model of federal framework setting and local autonomous adaptation provides continuous institutional guarantee for low-altitude economy and industrial development.

Second, policy instrument configuration presents a pattern of "hard environmental regulation, strong supply-side promotion, weak demand-side stimulation, and limited innovation empowerment.” Environmental policy instruments are abundant, supply-side instruments rank second, while demand-side and innovative instruments are insufficient. Environmental regulation constructs strict governance boundaries through laws, regulations, and standards, such as mandatory clauses in the *FAA Reauthorization Act*. Supply-side promotion balances direct and indirect supply, but demand-side stimulation instruments like government procurement are limitedly applied, reflecting that the free competition model struggles to form effective innovation incentives, potentially restricting industrial vitality and causing structural imbalance.

Third, policy effectiveness demonstrates “overall excellence with individual shortcomings.” The PMC index mean reaches the good rating, with a high proportion of policies rated good and above, and outstanding performance in goal setting and timeliness management. However, structural shortcomings remain, with uneven policy domain coverage, scarcity in political and cultural dimensions, and weak actor collaboration leading to insufficient cross-departmental linkage. Although the federal government ensures national uniformity, it inhibits industry autonomy, and the scarcity of departmental rules may pose risks of regulatory fragmentation, affecting policy implementation.

In summary, the excellent effectiveness of U.S. low-altitude economic policies, particularly its leading position in technical standard formulation and implementation and environmental policy instrument application, has laid the foundation for its international cooperation leadership and global rule shaping. For example, through deep participation in ICAO and ITU, the U.S. promotes compatibility of core rules such as eVTOL airworthiness certification and airspace classification, leads the “North American Low-Altitude Corridor” cross-border collaboration mechanism, and relies on leading enterprises to formulate international standards, possessing significant “internationalization” competitive advantages.

5.2 Research Implications

(1) Multi-dimensional Efforts to Guide Core Technology Bottleneck Breakthroughs and Deepen Innovation System Synergy and Ecosystem Construction

The U.S. technology-driven policy highly focuses on aircraft technology R&D, operational safety assurance, and system innovation, with core layouts in key technology areas such as “safety,” “technology,” and “uas,” forming a collaborative governance model of federal framework setting and local flexible adaptation, facilitating breakthroughs in eVTOL R&D and low-altitude UAV logistics. China should learn from its technology focus and institutional synergy experience, making multi-dimensional efforts from technology breakthrough, institutional synergy, and regional experimentation.

Specifically: First, precise core technology breakthroughs. The government should establish special funds for major low-altitude economy science and technology projects, focusing on "chokepoint" areas such as air traffic management systems, solid-state batteries, high-precision navigation, and aero-engines, further focusing on subdivided key technologies to guide enterprises in breaking through eVTOL distributed electric propulsion systems, UAV multi-sensor fusion perception and obstacle avoidance technology, low-altitude scenario 5G/6G high-reliability low-latency communication technology, and low-altitude traffic flow intelligent scheduling algorithms. Adopt organizational models such as "open competition" and "horse race mechanism" to guide deep integration of "government-industry-university-research-finance-service-application" and accelerate technology achievement transformation and industrial chain integration. Simultaneously, explore high-risk, high-return technology incubation mechanisms similar to U.S. ARPA-A, establish and optimize national low-altitude technology laboratories, and form eVTOL complete aircraft, flight control systems, and composite material innovation consortia based on national laboratories. Considering China' s large regional differences and rich application scenarios, promote technology R&D combined with regional needs, such as developing wind-resistant and rainproof specialized agricultural UAVs for southern hilly regions' "UAV weeding" and "tea leaf transport" needs, and breaking through long-endurance medical logistics UAV technology for western plateau regions' "blood sample transport" needs.

Second, full-chain innovation system coverage. Guide leading enterprises such as AVIC and DJI to deeply participate in the national low-altitude technology standards committee to dynamically update standards for eVTOL airworthiness certification, low-altitude aircraft noise limits, and UAV logistics operation norms. Establish a low-altitude economy intellectual property rapid rights protection center to implement priority examination for core technology patents and conduct cross-regional joint investigations of infringement behaviors to protect innovators' rights. Establish and optimize a "low-altitude technology trial-and-error mechanism" to provide partial cost compensation for R&D projects that fail at certain stages, encouraging frontier technology exploration and avoiding risk aversion that inhibits innovation vitality.

Third, regional collaborative experimentation and verification. Layout "cross-regional low-altitude technology comprehensive test fields" in the Yangtze River Delta, Guangdong-Hong Kong-Macao Greater Bay Area, and Chengdu-Chongqing twin-city economic circle to simulate diverse scenarios such as heavy rain, strong winds, dense urban buildings, and mountainous terrain for technology verification and application pilots. Build regional technology sharing platforms to promote complementarity among Shanghai' s low-altitude data algorithms, Shenzhen' s UAV R&D, and Chengdu' s aviation manufacturing foundation to avoid duplication. Establish a "test field results sharing mechanism" where verification data from any test field can serve as reference for nationwide airworthiness certification, accelerating technology landing.

(2) Optimize Dynamic Policy Instrument Combinations to Form Balanced Implementation and Adjustment Mechanisms Integrating

Rigidity and Flexibility

The U.S. relies on a policy instrument configuration of "hard environmental regulation, strong supply-side promotion, weak demand-side stimulation, and limited innovation empowerment," promoting low-altitude aircraft electrification transformation through strict regulations, but insufficient demand and innovation instruments restrict industrial vitality. China should learn from its environmental regulation and supply support experience to optimize policy instrument combinations and promote balanced rigidity-flexibility integration.

Specifically: First, precise supply-side empowerment. Establish a "low-altitude infrastructure PPP model," encouraging social capital investment in vertiport and low-altitude communication base station construction, ensuring investment returns through "user fees + government subsidies" to form a collaborative government-market construction pattern. Integrate meteorological, airspace, and traffic flow data to build a "national low-altitude data sharing platform," providing free basic data interfaces to enterprises and achieving sustainable data utilization through value-added data service charges to reduce enterprise data acquisition costs. Support undergraduate universities in establishing interdisciplinary subjects such as "low-altitude traffic engineering" and "eVTOL design and manufacturing," and add vocational directions like "low-altitude aircraft operation and maintenance" and "air traffic management assistance" in secondary and higher vocational schools to fill professional talent training gaps. Open "green channels" for overseas high-level talents in the low-altitude field, providing research start-up funds and settlement subsidies to attract top international talents. Encourage implementation of "enterprise new apprenticeship systems" where civil aviation schools cooperate with low-altitude economy enterprises to directionally cultivate skilled talents in low-altitude logistics operation and aircraft maintenance, solving industrial talent supply-demand mismatch.

Second, rigid constraints and flexible incentives on the environmental side. The government should guide enterprises, industry associations, and experts to formulate and improve mandatory standards for low-altitude aircraft noise control and carbon emissions, establish an airspace usage blacklist system, and impose high fines or flight bans on violating enterprises. Simultaneously, grant flexible incentives by establishing a low-altitude enterprise environmental credit evaluation system, rewarding enterprises meeting noise control and low carbon emission standards with airspace priority usage. Implement gradient management of "warning + rectification + punishment" for exceeding-standard enterprises to avoid "one-size-fits-all" approaches. Open policy consultation green channels to provide standard interpretation and compliance guidance services for small enterprises, reducing institutional transaction costs.

Third, demand-side market activation and scenario expansion. Implement government procurement priority catalogs (e.g., police patrol UAVs, medical emergency eVTOLs, ecological inspection UAVs). Launch "low-altitude economy consumption season" activities, promoting "aerial tour" consumption subsidies in tourist attractions and "UAV delivery discounts" in e-commerce industrial parks to stimulate public and enterprise demand. Establish cross-border logistics demonstration projects to promote "Belt and Road" low-altitude corridor construction, helping enterprises explore international demand markets.

Fourth, innovation-side inclusive trial-and-error and achievement transformation. The government should lead the establishment of "low-altitude economy sandbox regulatory zones" in pilot cities such as Beijing, Shenzhen, and Hefei, allowing enterprises to test disruptive models like shared eVTOL and UAV air taxis, clarifying sandbox trial-and-error scope and risk compensation mechanisms to reduce innovation trial-and-error costs. Provide subsidies and risk-sharing support for innovative low-altitude flight insurance products that meet certain conditions. Explore an innovation achievement replication and promotion mechanism, implementing a "one-place innovation, multi-place reuse" policy replication mechanism in low-altitude economy demonstration zones.

(3) Construct Multi-Level Systematic Policy Frameworks and Improve Multi-Dimensional Governance Systems

U.S. low-altitude economic policy effectiveness is "overall excellent with individual shortcomings." Although performance in goal setting, timeliness management, and synergy effects is commendable, problems such as imbalanced policy domain coverage and regulatory fragmentation risks exist. Therefore, China should learn lessons and construct multi-level systematic policy frameworks with top-level design, ministry coordination, local characteristics, and public participation to improve governance effectiveness.

Specifically: First, top-level design sets direction. Led by the CPC Central Committee and State Council, organize multi-party experts to formulate the *Low-Altitude Economy Development Promotion Law*, clarifying principled frameworks such as airspace classification management, infrastructure co-construction and sharing, and safety supervision baselines. Establish a "low-altitude economy development inter-ministerial joint meeting system" to regularly convene meetings to solve cross-domain issues such as airspace approval, cross-regional scheduling, and data security, avoiding policy fragmentation and functional overlap.

Second, ministry coordination sets standards. Relevant departments including the Ministry of Industry and Information Technology, Civil Aviation Administration, Ministry of Natural Resources, Ministry of Public Security, and Cyberspace Administration of China should jointly formulate departmental rules covering the entire chain, further refining implementation standards for airworthiness certification, data security, and operation permits. Establish a dynamic rule revision mechanism, forming an evaluation group with industry associations, university think tanks, and technical experts to conduct systematic assessments of the standard system every two years, promptly incorporating mature technical standards into rules to ensure policy applicability.

Third, local characteristics seek development. Encourage local governments to formulate differentiated policies based on resource endowments, such as

Henan issuing "low-altitude + smart agriculture" special policies supporting UAV plant protection and farmland monitoring around its major agricultural province needs; Hainan exploring "low-altitude cross-border tourism" pilots relying on its free trade port advantages to simplify temporary entry approval for foreign aircraft; Heilongjiang formulating "low-altitude + forest fire prevention" emergency plans and establishing UAV rapid response teams for forest area characteristics. Simultaneously, the government should establish effective "local policy mutual recognition" mechanisms and policy agents to reduce enterprise cross-regional operation costs.

Fourth, public participation strengthens supervision. The government should build a "low-altitude economy public supervision platform," launching online supervision apps to encourage public reporting of "black flights,"noise disturbances, and other violations, rewarding effective reports to form social supervision synergy. Regularly hold "low-altitude economy public hearings," inviting residents and industry association representatives to participate in policy formulation such as vertiport site selection and flight route planning to enhance public sense of gain. Conduct "low-altitude economy science popularization into campuses, communities, parks, and factories" activities to improve public and employee cognition and acceptance of the low-altitude industry through VR simulated flight, physical exhibitions, and short video promotions, creating a harmonious ecosystem.

(4) Proactively Lead International Standard Cooperation and Enhance Multi-Pathway Discourse Power in Low-Altitude Economy Rules

The U.S. leverages policy advantages to shape global rules through deep ICAO participation and leading the "North American Low-Altitude Corridor," possessing significant "internationalization" competitive advantages. China needs to move beyond passive participation and adopt an integrated strategy of "taking the lead with two-way linkage," guiding standard formulation in international cooperation, deepening cooperation through standard output, and enhancing rule discourse power.

Specifically: First, seize opportunities in international organizations. In core platforms such as ICAO and ITU, jointly initiate topics like "low-altitude intelligent transportation system architecture," "eVTOL airworthiness certification mutual recognition," and "low-altitude data cross-border flow security" with emerging market countries including Russia, Brazil, and Southeast Asian nations, promoting the establishment of a "UAM special working group" to seize rule drafting initiative. Relying on the "Belt and Road" green development advantage, establish a "low-altitude economy technology cooperation center" to provide low-altitude policy formulation consulting and technical training services for developing countries, transforming Chinese practical experience into international consensus and enhancing topic dominance.

Second, build benchmarks through regional cooperation. Deepen regional low-altitude economic cooperation, jointly build "cross-border low-altitude logistics corridors" with Vietnam and Thailand to simplify cross-border approval processes for agricultural product UAV transport and reduce trade costs. Layout "low-altitude economy demonstration bases" in Southeast Asia, Africa, and other regions, with leading enterprises exporting eVTOL complete aircraft, air traffic management systems, and operation models, supporting construction of maintenance service centers and talent training schools to form an integrated output model from technology to standards to services, creating de facto regional standards. Simultaneously, rely on platforms such as the Central Asia Summit and SCO Summit to promote the establishment of regional low-altitude economic cooperation mechanisms and expand rule radiation scope.

Third, break barriers in standard fields. Promote the establishment of "airworthiness standard mutual recognition agreements" between the Civil Aviation Administration of China and European EASA and U.S. FAA to reduce repeated certification costs for Chinese eVTOL and UAV exports and lower trade barriers. Sign "low-altitude airspace management cooperation memorandums" with Belt and Road partner countries to mutually recognize airspace classification standards and flight permits, achieving "one approval, multi-country passage." Build an "international scenario library" using privacy-enhancing technologies such as federated learning to break data cross-border flow dilemmas while ensuring data sovereignty, exporting a trustworthy "China solution."

Fourth, strengthen support for enterprise globalization. Support leading enterprises to move from "product globalization" to "ecosystem globalization," providing enterprises with "international certification convenience services" to assist in obtaining EASA and FAA airworthiness certifications. Establish a "low-altitude enterprise overseas rights protection mechanism," relying on Chinese embassy economic and commercial offices abroad to provide support for enterprises facing overseas intellectual property disputes and trade barriers. Encourage enterprises to build "lighthouse factories" integrating manufacturing, operation, management, and training in Belt and Road partner countries, landing Chinese technical standards, operation and maintenance systems, and management rules as integrated packages to form global competitive advantages and achieve the leap from technology adoption and rule mutual recognition to final standard co-recognition.

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Author Contribution Statement:

Wang Chuanlei: Proposed the research topic, provided direction guidance, reviewed and revised the paper.

Li Lin: Collected and processed data, wrote and revised the paper.