中国低空经济发展的理论逻辑、现状分析与促进策略

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摘 要：低空经济作为新质生产力的典型代表，正成为推动我国经济高质量发展的新增长引擎。本文以我国低空经济产业的发展历程与现状特征为切入点，深入剖析了低空经济产业在技术突破、政策引导和资本供给“三重驱动”下迅猛发展的内在动力机制。同时，文章指出，我国低空经济产业现阶段仍面临若干深层次瓶颈，包括部分技术仍存霸凌制裁风险、产业配套设施建设不规范、商业模式探索不足、市场公众接受程度较低，以及法律法规和监管机制滞后等挑战。为此，本文基于产业生态系统理论的研究视角剖析低空经济产业的发展模式和现实挑战，并提出推动科技创新与产业创新深度融合是解决当前发展困境的关键路径。在此基础上，本文进一步从深化示范城市建设、培育创新主体与专业人才、完善监管治理体系和拓展国际合作空间四个维度提出具体政策建议，旨在为中国低空经济高质量发展提供切实可行的理论指导与实践方向。

关键词：低空经济；科技创新；产业创新；新质生产力

JEL 分类号：O53；O31；O38

一、引言

随着新一轮科技革命和产业变革的深入推进，以人工智能、新能源、数字经济等为代表的新兴技术正持续重塑传统经济结构，世界百年未有之大变局也在加速演进（白雪洁、朱泽原，2024）。在此背景下，我国以习近平经济思想为理论指导，提出要扎实推动科技创新与产业创新深度融合，以重大技术突破和重大发展需求为基础，培育壮大战略性新兴产业，构筑高质量发展的新优势，加快形成新质生产力。2024年第11期《求是》杂志发表了习近平总书记《发展新质生产力是推动高质量发展的内在要求和重要着力点》一文，文章指出“新质生产力是创新起主导作用，摆脱传统经济增长方式、生产力发展路径，具有高科技、高效能、高质量特征，符合新发展理念的先进生产力质态”。而低空经济作为融合航空技术、智能控制、通信导航、新能源等多领域的新兴经济形态，正是新质生产力的典型体现。这一综合性产业形态伴随着科学技术的突破和商业模式创新而生，不仅契合国家战略性产业发展的布局需求，更以其科技突破、创新驱动、技术赋能等特征，迅

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基金项目：中国社会科学院青年人文社会科学研究中心社会调研项目“低空基础设施建设的制约因素与优化对策研究”（项目批准号：2026QNZX028）。

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速崛起为我国重点发展的万亿级新赛道产业(倪红福等,2025)。2023年中央经济工作会议首次明确将低空经济列为战略性新兴产业,2024年《政府工作报告》将其列为新增长引擎,充分体现了党和国家对发展低空经济的高度重视。低空经济产业不仅承继了传统通用航空的业态基础,同时融合了无人机、智能控制、卫星导航等先进技术,形成了以多技术融合为支撑的新型高科技低空生产服务体系。

尽管目前我国低空经济产业处于产业发展和市场培育的早期阶段,市场需求尚未完全释放,但其前景已展现出巨大潜力。根据中国民用航空局的数据预测,到2035年,我国低空经济产业的市场规模将达到3.5万亿元[①]。此外,低空经济产业并非孤立存在,其覆盖范围横跨能源、交通、制造、农业、物流等多个行业,多元化的产业需求正在催生多行业协同发展的全新格局。未来,低空经济有望以"多元产业带动+多场景应用"的复合型产业体系,嵌入并改造升级传统产业、培育未来产业,并凭借强大的产业带动效应,有效促进产业链上下游的融合发展,拓展更为丰富的市场应用场景。

从产业生态系统理论的视角来看,低空经济的产业发展不是单个企业的行为,而是由企业、政府、科研院所、金融机构等多元主体,通过知识、技术、资本等要素在动态环境中互动协同,形成共生、演化与价值共创的新兴产业系统。在产业生态系统中,企业、政府、用户以及科研院所构成了低空经济产业的主体要素;技术、资金、数据、人才构成了低空产业生态系统的资源要素;政策法规、市场需求、基础设施、社会文化构成了低空经济产业的环境要素。产业生态理论认为,一个产业的蓬勃发展关键在于能够持续与周围的环境和资源形成良性互动,通过价值共创和互通机制实现要素交换,强化该产业在生态系统中的地位(娄美珍、俞国方,2009)。从这一角度出发,低空经济的快速发展得益于能够从产业生态系统的资源和环境要素中持续汲取"营养",是资源要素和环境要素催生的结果。例如,低空飞行器集成了先进技术工艺,通过碳纤维复合材料、智能化涂层等新型材料的应用,显著提升了飞行器的续航能力和气动性能。在政策扶持下,以电动垂直起降飞行器(eVTOL)为代表的新型低空飞行器在各地区开展试点,展现出城市空中交通的未来趋势。资本的大量注入促进了低空经济与多领域深度融合,衍生出新的商业运营模式与服务业态,推动无人机等新型航空器的发展,并广泛应用于物流配送、观光文旅、农林植保、应急救援等行业。

伴随着我国空域管理改革和低空开放试点的逐步推进,低空经济正逐渐从传统通用航空产业中独立出来,形成了新的产业形态。低空经济的兴起可视为对通用航空产业的一次技术重构与范式超越,其发展也为科技创新和产业创新深度融合提供了新的契机。从科技创新层面看,低空经济产业集成了5G通信、北斗导航、人工智能等新一代信息技术以及新型复合材料、电机电控系

[①] 资料来源:中国交通新闻网"低空经济加速腾飞",2025年3月6日,https://www.mot.gov.cn/jiaotongyaowen/202503/t20250306_4165146.html。

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统、飞行器小型化等前沿工程技术，打破传统创新模式分散难以协同的障碍，构建起“技术－平台－应用”一体化的创新生态，为产业发展提供了坚实的技术支持，实现了低空产业生态系统主体要素和资源要素的互通（欧阳日辉，2025）。从产业创新角度看，低空经济激发了农业、制造业、服务业、公共管理等多个领域的深度联动，推动创新场景应用持续涌现（赵景龙，2025），通过低空服务带动价值创造，以新场景开发为创新试验平台，进而推动政策落地、满足市场需求，实现了低空产业生态的主体要素和环境要素的互通。从这一意义上看，低空经济不仅是一个新兴产业，更是推动科技创新和产业创新协同发展的重要突破点，为我国实现战略性新兴产业的“换道超车”提供了重要路径。

本文在系统梳理我国低空经济产业发展历程与现状特征的基础上，深入分析低空经济的增长动能、潜在优势及高质量发展面临的现实挑战。与新能源汽车、云计算等其他新兴产业不同，低空经济作为多技术融合的产业形态，其应用场景多元化且高度不确定，未来在何种场景、以何种方式实现规模化发展尚不明确。因此，本文基于产业生态理论的研究视角，提出低空经济的发展应当秉持科技创新与产业创新融合的基本路径，通过科技创新与产业创新的深度融合破解当前发展瓶颈。本文的主要边际贡献在于从科技创新与产业创新融合发展的视角构建低空经济高质量发展的理论框架，并在此基础上提出具体的实践路径与政策建议。

二、中国低空经济产业的发展历程与现状特征

（一）低空经济产业的发展历程

低空经济产业在我国的发展历程主要可以分为萌芽起步、初步发展和高速成长三个阶段（见图1）。2010年之前为低空经济产业的萌芽探索阶段。这一时期我国航空产业发展主要以传统通用航空为核心，低空经济尚未被系统提出与认可，相关技术仍不成熟，处于早期探索阶段。此外，空域管理权限高度集中在军事部门，飞行审批流程繁琐，导致民用通用航空产业整体处于边缘位置。这一时期的通用航空主要应用于农林植保、航空摄影、气象探测等公益性或作业性领域，商业化和民用化需求十分有限，产业成熟度较低。

2010—2020年为低空经济产业的初步发展阶段。这一阶段，低空经济在学术研究、技术创新和政策支持方面取得了重要突破。首先，在学术领域，2010年起我国学界开始关注并提出“低空经济”这一概念，围绕这一主题展开了广泛的讨论与研究，逐渐进入公众视野[②]。其次，在技术创新方面，以无人机为代表的低空飞行器技术快速突破，与北斗导航、5G通信等新兴技术融合，无人机

[②] 资料来源：江苏科技智库“低空经济产业发展历程及相关行业政策综述”，2024年5月16日，https://www.skzlyjy.org.cn/web/artlist/360。

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的商业应用快速拓展，航拍测绘、农业植保、环境监测、灾害救援等领域均出现了显著增长（倪红福等，2025）。再次，在政策层面，党中央、国务院陆续出台了一系列鼓励探索和开放低空空域资源的政策文件。2010年，国务院和中央军委联合发布《关于深化我国低空空域管理改革的意见》，提出以试点、推广、深化三个阶段稳步推进低空空域管理改革。2016年，国务院办公厅发布《关于促进通用航空业发展的指导意见》，明确提出要进一步扩大低空空域开放，优化飞行服务及审批效率，为产业发展创造了良好的政策环境。

2021年以来，中国低空经济产业进入高速发展阶段。在政策推动、技术突破、资本供给等多重因素的协同作用下，低空经济逐步从传统通用航空的延伸产业转变为独立的战略性新兴产业。2021年2月，中共中央、国务院印发《国家综合立体交通网规划纲要》，首次将低空经济提升至国家

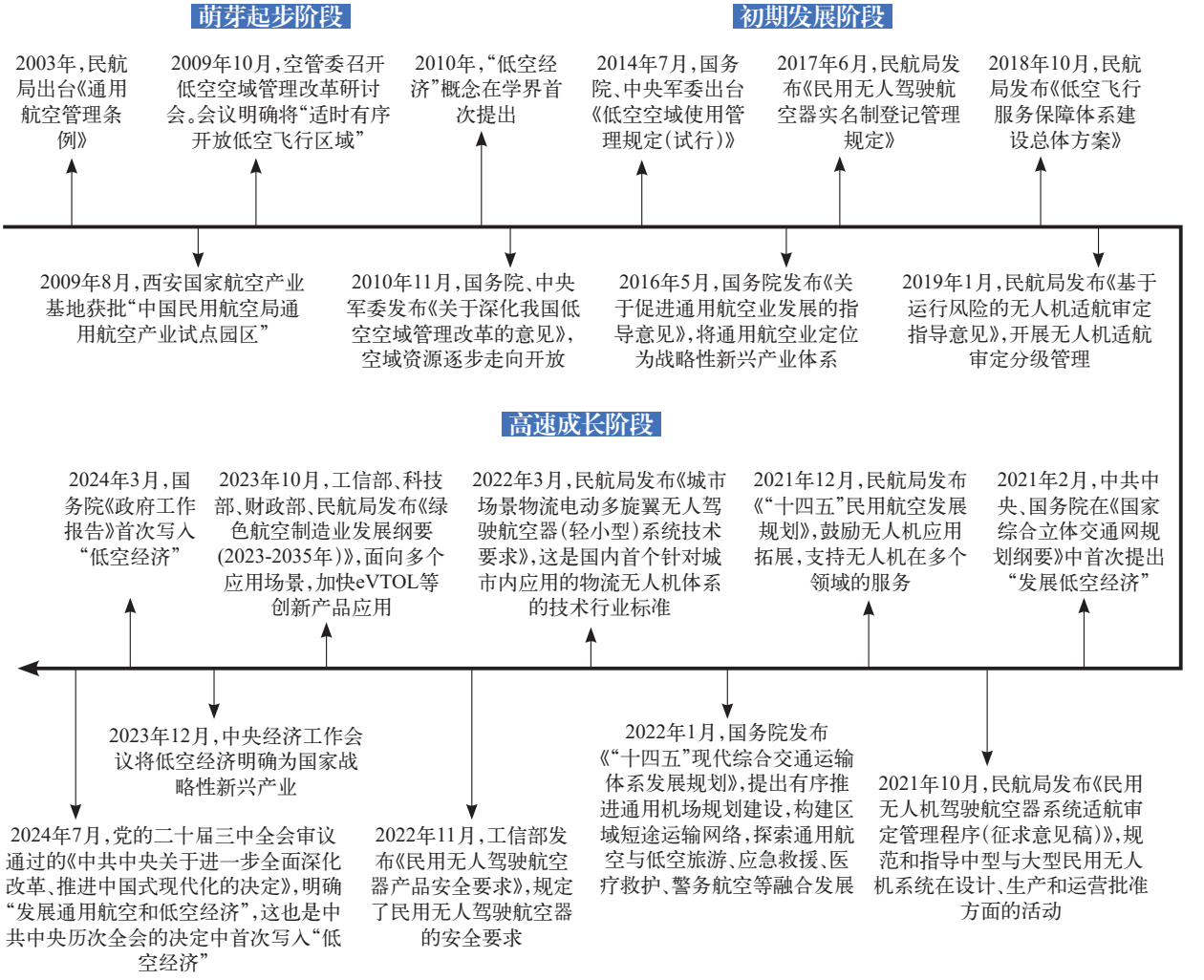

图1：低空经济产业的发展历程

资料来源：作者根据2018－2024年民航行业发展统计公报绘制。

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战略层面，明确产业发展的方向与目标。经过多年技术积累和市场探索，2021年后我国低空经济产业呈现爆发式增长态势。以无人机产业为例，全行业注册无人机数量由2020年的51.7万架增长至2021年的83.2万架，增幅超过60%，随后几年仍保持45%以上的年增长率。全行业无人机有效驾驶员执照由2020年的约8.90万本增长至2021年的12.08万本，增幅超过35%。截至2024年底，我国全行业无人机注册数已达到217.7万架，全行业无人机拥有者注册用户161.9万个，共颁发无人机操控员执照27.33万本，全年无人机累计飞行小时达2666.7万小时[③]。

2023年12月，中共中央经济工作会议明确将低空经济列为国家战略性新兴产业。2024年《政府工作报告》首次将低空经济定位为“新增长引擎”；同年，党的二十届三中全会强调“发展通用航空和低空经济”。2025年《政府工作报告》进一步提出要“推动商业航天、低空经济、深海科技等新兴产业安全健康发展”，再次强调低空经济的战略地位。此外，各省市政府工作报告纷纷提及低空经济，并陆续出台低空经济专项发展规划。地方政府积极布局、资本市场持续关注，再加上国家发展改革委专门设立低空经济发展司，表明我国低空经济的发展政策持续加码，发展路径愈发清晰，产业发展动力日益强劲。

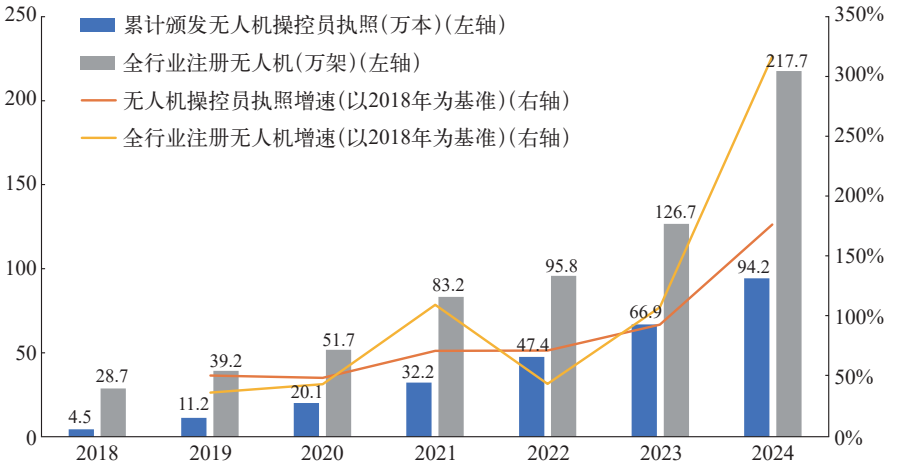

图2：2018－2024年无人机产业发展情况

资料来源：作者根据2018－2024年民航行业发展统计公报绘制。

（二）低空经济产业的现状特征

现阶段，我国低空经济已具备迈向规模化、常态化和可持续发展的基础。作为战略性新兴产业的重要组成部分和新质生产力的典型代表，低空经济正在从试点示范阶段快速迈向规模化应用阶段。随着商用范围的不断扩大和应用场景的持续拓展，低空经济表现出明显不同于传统通用

[③] 资料来源：作者根据《2024年民航行业发展统计公报》整理。

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航空产业的创新发展特征。

从产业创新层面看，低空经济通过信息化和数字化技术的赋能，持续拓展低空应用场景，不断催生新的产业形态与商业模式（王树森、倪红福，2025）。除了替代传统通用航空执行物流配送、农林植保和应急救援等任务外，依托信息技术的广泛应用，无人机编队的大规模使用进一步推动了“低空+”融合的新兴业态，如“无人机+表演”“无人机+文旅”“无人机+直播”等，大幅拓宽了低空经济的产业边界。同时，随着电动垂直起降飞行器（eVTOL）等载人飞行技术逐步成熟，低空经济在城市内部点对点通勤方面展现出巨大潜力。相比传统飞行器，eVTOL具备无需长距离跑道即可在高楼屋顶、城市边缘小型空间起降的独特优势，高度契合城市高密度空间特征，能够有效解决传统飞机与地面交通的局限问题。

从科技创新层面看，低空经济表现出三个特征。一是技术高度集成。低空经济融合多个领域的前沿技术，形成一种高度复合的技术创新体系。低空飞行器制造环节广泛应用轻量化复合材料、新型耐腐涂层、电动推进系统、高能量密度动力电池等先进技术，大幅提升了飞行器的安全性、稳定性与续航能力。二是系统协同能力强。依托低空空域管理系统、数字孪生平台和空地一体化通信链路等先进软硬件协同机制，飞行器之间以及飞行器与地面控制系统实现高效协同，显著提升了多飞行器同时运行时的安全性和监管效率。例如，低空空域管理系统通过飞行器身份认证、飞行审批、空域划设、轨迹追踪、冲突预警等功能，保证多架飞行器同时运行时不碰撞、不冲突、可回溯。三是智能化水平高。借助红外探测、激光雷达等传感器以及人工智能算法和大数据分析的广泛应用，当前低空飞行器已经从“人工操控”逐步转变为具备“智能感知—自动决策—协同执行”能力的自主系统。飞行器在明确任务目标后，可实现自主决策，减少对人工遥控的依赖，提升复杂环境下的飞行稳定性和任务执行能力。

三、中国低空经济产业的增长动能与潜在优势

低空经济产业作为新兴的战略产业，其发展目标是“由点及面”，在全国范围内形成具有持续增量的规模化产业体系。同时，低空经济本身作为一个高度融合政策、技术与市场的复合型产业，其发展和推广具有高度的不确定性与复杂性，只有深刻理解其增长动力，才能从根本上把握该产业演进的内在逻辑，从而精准制定政策导向、提前规划产业布局，引导低空经济从“局部试点”走向“全域推广”。鉴于此，本节基于我国当前低空经济的发展现状，梳理了低空经济产业的增长动能，并依据实际国情进一步论述我国未来发展低空经济产业的潜在优势。

（一）低空经济产业的增长动能

从当前发展实践来看，低空经济产业的兴起并非偶然，而是多重因素共同作用的结果，具有

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时间偶然性和现实必然性。其中，技术突破、政策引导以及资本供给三者共同构成了驱动低空经济产业增长的核心因素，是助力低空经济由“起飞”向“高飞”的核心驱动力量。

1.技术突破是推动低空经济产业发展的首要条件

低空经济本质上是一个以科技为核心驱动力的新兴产业形态，其发展高度依赖于关键技术的创新与集成，也正是由于科学技术的突破才使得低空经济产业落地成为可能。从产业链视角来看，低空经济上游的飞行器制造，中游的飞行器控制与调度，下游的飞行任务执行与场景应用均需要以相关的技术突破为基础条件。以无人机为例，新型材料和高能电池的应用才使得其解决了原本存在的飞行安全和续航问题，将飞行器制造从“概念”延伸至“现实”。而5G通信和北斗导航技术的应用实现了飞行器在空中与地面进行信息交互和精准定位，解决了传统航空业或通航业的CNS系统或雷达体系无法满足低空飞行器的发展需求的问题，实现了飞行器实时感知、快速调度与空中避障等技术。此外，依托算力技术提升和人工智能的运用，飞行器能够在虚拟系统中进行仿真模拟，并通过自主学习具备一定自主决策能力，极大地拓展了飞行器应用场景。如果没有这一整套技术体系的支撑，低空飞行不仅难以实现高密度、安全有序运行，甚至会带来巨大的公共安全隐患。正因如此，技术突破构成了低空经济产业增长过程中基础性、首要性条件，是一切低空经济场景应用和模式创新的根本前提。

2.政策引导是加速低空经济产业增长的关键一环

除了技术密集以外，低空经济产业还具有明显的高投入、高风险和强制度依赖的特征。低空经济产业发展面临基础设施配套、空域资源申请、飞行安全监管、气象条件评估、法规安全认定等一系列系统性、制度性障碍；单单依靠市场机制实现上述资源不仅效率低、进展慢，且多数问题难以解决。在这一背景下，政府的政策指引为低空经济发展提供了制度保障，也为潜在的低空产业风险提供了“破题”和“托底”的作用。一方面，低空空域属于国家战略性核心资源，如何使用、如何开放、如何监管以及如何明晰使用规则是确保低空经济安全健康发展的关键因素。近年来，中央和地方政府出台了《“十四五”通用航空发展专项规划》《无人驾驶航空器飞行管理暂行条例》《深圳市低空经济产业创新发展实施方案(2022—2025年)》等多项支持政策和规章制度，不仅打开了空域开放的制度闸门，为产业释放发展空间，同时还提升了市场对低空经济产业发展的信心，为低空行业增长注入了新的活力。另一方面，低空经济产业发展需要完善的基础设施建设和通信配套设备，例如通航机场、通讯基站、监管平台等，而这些配套设施建设成本高、周期长，短期回报效益低，仅依靠企业投入难以为继。各地政府通过试点示范、产业孵化等方式提供扶持，有效降低了企业进入门槛，推动项目快速落地，有力地促进了低空经济产业链上下游的快速增长。正因如此，政府政策引导成为驱动低空经济产业近年来快速增长的关键一环。

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3.资本供给是推动低空经济快速崛起的重要助力

随着中国经济发展进入转型期，如房地产、重工业、组装制造等传统高能耗、高杠杆、高劳动密集型行业逐步降低了原有比较优势，资本开始主动寻求新的增值渠道，谋求新的增值空间。低空经济不仅具备技术密集度高、产业链长、应用前景广阔的商业应用条件，而且应用场景多元并与人工智能、新能源等产业深度融合，被视为未来新质生产力的代表。因此，低空经济及其相关产业迅速成为资本市场关注的新焦点。资本市场的关注与资金的供给为低空经济的快速崛起带来了三大助力。一是有效缓解了低空经济初创企业在技术攻关、原型试飞、商业模式验证等阶段面临的“烧钱”困境。一方面，资本供给为企业构建技术壁垒提供了可能，使得飞行器动力电池、智能空管系统等核心软硬件技术加速成熟，研发及应用周期缩短。另一方面，资金的大量注入也为企业前期在物流、文旅、巡检、城市空中出行等多场景中探索可持续的盈利模式提供了保障，从而加快推动了整个行业的商业化进程。二是随着资本对低空经济的积极投入，该领域的社会关注度与政策感知度显著提升。在众多知名投资机构、产业资本的大举投资带动下，公众、媒体等其他主体对低空经济产业的关注度提升进一步引发了多地政策层面的积极响应。例如，深圳、成都、苏州、杭州等地密集出台低空经济产业规划，设立上百亿资金规模的专项产业基金，支持本地企业发展，构建试点空域与空管平台。此外，资本供给还显著提升了低空相关企业和整个行业的抗风险能力。在技术迭代快、市场尚未完全成熟的初期发展阶段，资本的大量注入不仅是生存资金，更是“时间窗口”的保障。资本助力下的企业能够抵御初期亏损，集中资源攻克关键技术并开展试点运营，以此度过产业前期的“寒冬时刻”。此外，有资本背书的项目也更容易获得政府部门的试点许可，这无疑加速了低空经济产业的发展进程。

（二）中国推动低空经济产业高质量发展的潜在优势

作为连接多种前沿科技产业的重要交汇点，低空经济被视为培育“新质生产力”的关键方向，也成为推动交通运输模式变革、应急救援现代化和智慧城市建设的重要支撑。近年来，我国政府高度重视低空经济的发展机遇，将其纳入战略性新兴产业加以统筹部署。从政策推动、技术突破到资金支持、市场培育，力求推动产业从早期探索迈向有序扩展。在推动低空经济高质量发展的过程中，中国的制度优势、市场规模、产业基础等因素共同构成了推动低空经济高质量发展的独特优势（倪红福、王树森，2025）。

1.超大市场规模构成消费需求与人才供给的双重红利

根据国家统计局数据，2024年末我国人口总量约为14.08亿，庞大的人口规模形成了低空经济产业未来发展消费需求和人才供给的双重红利。一方面，庞大的人口基数意味着广阔的消费市场。随着我国中等收入群体人数不断扩大，居民消费结构和能力也随之升级。特别是对于城市中

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等收入群体而言，个性化、便捷化、高效率的服务需求成为优先选项。例如，无人机配送在需求端提升了传统物流的配送时效和便捷程度；eVTOL载人运输实现了城市内出行相较于传统通勤手段更快速、更便捷；未来这些应用场景所面对的都是一个拥有十几亿人口的超大市场，这为企业开展商业化应用与规模化运营提供了广阔的“蓝海市场”。另一方面，庞大的人口也带来了充裕的人才供给，为低空经济的长期高质量发展奠定了人才基础。根据教育部公布的数据，2024年我国共招收研究生135.68万人，其中招收博士生17.11万人，硕士生118.57万人。而同年我国在校研究生已达到409.54万人，在学博士生67.63万人，在学硕士生341.92万人[④]。强大的人才储备构成了未来低空经济发展的人才“蓄水池”，使低空经济不仅“有人可用”，更能“用其所长”，推动从技术研发到产业落地全链条发展。因此，中国人口规模不仅意味着消费端的庞大市场潜力，也意味着供给端的人才资源优势。这种“双重红利”构成了中国低空经济发展过程中极具战略意义的内生动力，形成了独一无二的低空产业发展优势。

2.完善产业链体系，构筑低空经济高质量发展的坚实基础

低空经济是一个融合航空航天、新能源、通信导航、人工智能等多领域的新兴产业，其发展高度依赖上下游环节的紧密衔接与协同能力。中国当前具备全球最完善的产业链体系，涵盖41个大类、207个中类、666个小类的全产业链生产能力。这种完备的产业供应能力不仅使中国在电池、复合材料、导航系统、无人机制造等关键技术领域具备全球领先优势，而且促进了这些技术在低空经济场景中的高效集成与推广应用。此外，在完备产业链背景下，我国培育了大量成熟的中小企业和配套供应链体系，为低空经济的飞行器制造、设计、研发、测试、维修提供了高质量、可持续的服务。广泛的制造业分布与完善的产业链配套体系覆盖了低空经济产业从上游设计制造到下游场景应用的全产业链过程，能够加速低空产品从“概念”到“应用”的快速落地，这为低空企业根据市场需求快速调整产品结构和服务模式提供了坚实基础，增强了产业的灵活性和适应性。同时，完善的产业体系还能够带来成本优势。得益于雄厚的制造业基础、成熟的供应链体系和发达的物流网络，中国的低空产品能够通过规模化生产降低各产业环节基础成本，并在全球竞争中获得明显的成本优势。

四、低空经济高质量发展的现实挑战

在政策引导、技术突破和市场需求的共同驱动下，低空经济呈现出快速扩张与多点布局的态势，成为当前科技创新与产业创新融合发展、培育新质生产力的典型表现。虽然低空经济在推动科技创新与产业创新融合方面的潜力日益凸显，但伴随产业发展，也暴露出诸多结构性和制度性

[④] 资料来源：《2024年全国教育事业发展统计公报》。

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挑战。因此，厘清和系统分析这些现实挑战，不仅是推动低空经济高质量发展的着力点，也是实现科技创新链与产业价值链有效耦合的必要基础。

（一）低空经济部分技术仍存在霸凌制裁风险

近年来，依托强大的产业链和完备的制造业体系，我国在无人机制造、飞控系统等领域取得显著进展，基本实现了绝大多数低空飞行器零部件的独立设计和制造，多项技术处于国际领先水平。但对于部分核心中高端零部件，我国仍存在一定程度的进口依赖，面对部分国家霸凌制裁威胁，我国低空经济产业长期发展主要存在以下三个方面风险问题。一是高性能航空零部件仍存在较强外部依赖。虽然我国航空产业发展已经取得长足进步，但就航空发动机、航空控制系统而言仍与国际顶尖水平存在差距，核心技术严重依赖进口（张晓兰、黄伟熔，2024）。二是高端飞控芯片自主可控性差，技术存在短板。未来低空飞行器与人工智能等前沿技术相融合是必然趋势，这对飞行器芯片的运算和控制提出了更强、更稳定的要求。而现阶段，我国在高端飞控芯片方面仍存在明显的制造短板，无法实现生产的完全自主可控，长期发展可能制约低空经济产业的可持续发展。三是低空领域精确测绘、智能传感器等技术与国外尚存在一定差距。当前广泛应用的部分高精度雷达设备和传感器等仍依赖于国外成熟产品，国内产品替代率低，技术尚不成熟，一旦被技术“断供”，将对我国低空飞行安全构成潜在威胁（张晓兰、黄伟熔，2024）。

（二）产业配套基础设施建设进度缓慢、布局尚不完善

目前我国低空经济的发展面临基础设施建设缓慢和规范标准不统一的突出问题。一方面，物理基础设施总量较少、区域布局不平衡、建设标准不统一。截至2024年底，我国在册的通用机场数量达到475个，美国通用机场数量共计19482座，其中包括5146座公共机场和14336座私人机场[⑤]。同时，我国的机场分布多数集中于东部沿海和经济发达地区，中西部和边远地区这些空域资源丰富、场景应用广泛的地区反而机场覆盖率低，难以支撑广域且连续的低空飞行服务网络。从布局上看，现有基础设施存在层级不清、功能重复、选址分散等问题，导致基建设施运行效率不高、资源配置不合理。从建设角度来看，eVTOL起降平台、油站、气象站等新型基础设施发展缓慢，尤其是一些省市虽然启动了低空基础设施的规划和招标项目，但由于缺乏统一的建设标准，项目难以顺利落地。这在一定程度上制约了低空经济的场景应用和市场扩张。另一方面，软件基础设施配备也存在短板。地理信息服务、空域运行监控平台等关键软支撑系统尚不完善，相关数据标准缺失、不同地区系统接口不统一，难以实现软硬融合与平台互通，阻碍了低空产业的协同发展。

[⑤] 资料来源：美国联邦航空管理局“航空交通数据”，2025年7月30日，https://www.faa.gov/air_traffic/by_the_numbers。

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（三）商业模式尚未成熟，盈利路径较为单一

低空经济产业覆盖通用航空、无人机运输、城市通勤以及农业植保等诸多领域，但整体而言，多数行业和企业仍处于初期探索阶段，尚未形成成熟的商业体系和盈利模式，产业未来发展方向不清晰，市场盈利效果相对较差。此外，目前多数通航和无人机企业的应用对地方财政补贴、资金项目和政策红利有所依赖，尚未形成完备的企业自我造血能力，一旦政策支持力度和资金供给减弱，企业将直接面临运营危机，难以长期维系。同时，部分探索的低空产业融合项目，如低空文旅、低空出游等过于依赖地区特殊地理环境，应用场景开发地区专属性太强。例如，“低空+文旅”的经营模式必须依托于城市本身丰富的文化风景资源，而在产业探索过程中，低空产业本身未能形成标准化服务模式，导致其他区域难以规模复制、无法大规模铺开，限制了产业的进一步发展。

（四）公众接受度较低，市场需求尚未完全激活

尽管低空经济在政策支持和技术突破下发展迅速，但从用户端看，社会公众对于衍生的各类低空业态接受度依然较低，潜在的市场需求尚未有效转化为实际消费能力，这也成为制约低空经济高质量发展的关键障碍之一。首先，公众对低空飞行器安全性仍存在疑问。不同于传统民航飞行器，现阶段的各类低空飞行器尚属于新兴产品，公众对其飞行稳定性、安全性等存在一定疑虑，容易产生恐惧情绪和信任壁垒，从而降低低空产品的消费意愿。其次，现阶段低空产品服务成本与定价偏高，制约了消费需求。当前开发的低空应用场景，如城市空中通勤、空中物流运输等普遍存在成本高企的问题，与传统通勤及物流行业相比，虽然具有时间成本优势，但尚未形成价格优势，服务成本高昂，公众接受意愿较低。此外，应用场景成熟度低，公众日常使用频率不足。当前的各项低空产业仍多以临时性体验为主，距离公众日常化使用还有一定距离。同时，现阶段低空飞行器设备对气象环境适应能力较为薄弱，无法满足公众对物流、通勤等服务的全天候使用需求，制约了低空产业发展活力。

（五）法律法规与监管机制较市场需求相对滞后

由于当前的低空经济发展已显著区别于传统通用航空行业发展模式，正逐步演变为一个新兴产业，这也导致原有的法律法规和监管机制与实践之间存在脱节，难以满足新兴技术和商业模式的监管需要。伴随着低空产业发展，产生了空域安全问题、隐私侵权问题与数据主权等相关问题亟待解决（陈永伟，2025）。但现有的《中华人民共和国民用航空法》和《通用航空飞行管制条例》等法律法规对于上述问题尚未作出明确规定，且立法存在“碎片化”和“权威不足”等问题（蒋中麒、冯雪，2025）。一旦产生纠纷，则会出现企业或公众维权的“权责不清”“依法不明”等问题，增加企业在开展低空飞行、物流运输、空中旅游等活动中面临的不确定性风险。同时，现阶段对于低

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空产业的监管手段也相对滞后。面对无人机、eVTOL等快速崛起的新技术、新产业，缺乏明确的规制性、约束性手段。各地区地方政府虽开展了一些先行试点，但整体缺乏顶层设计和统一标准，存在各地标准不一、政策碎片化问题，如大型无人机、飞行汽车等低空飞行器审批流程仍然繁琐、效率较低。此外，监管力量与技术手段不足也是一大难题。低空飞行的业务范围分布广、产品流动性强，对气象实时监测、风险预警与飞行管控提出了极高要求，但现有的低空空管系统在雷达覆盖、数据共享、空管人员能力等方面存在明显短板，可能存在一定安全性与监管风险。

五、以科技创新与产业创新相融合推动低空经济产业高质量发展

（一）依托科技创新与产业创新相融合破解低空经济产业发展困境

经过数年的蓬勃发展，现阶段低空经济日益成为推动我国经济高质量发展的新引擎。然而，产业在快速发展过程中也暴露出一系列深层次困境。技术层面困境包括低空产品核心技术“卡脖子”、产品服务成本高等；应用层面挑战包括产业配套设施不完善、商业模式不成熟、公众接受度低以及法律法规监管滞后等。从产业生态理论视角来看，上述发展困境本质上回归到了产业生态主体和资源、环境要素如何实现要素交互、适应与进化的问题。面对这一系列问题，产业生态理论认为仅依靠技术攻关或产业创新都难以从根本上解决当前低空产业所存在的发展困境，唯有推动科技创新与产业创新深度融合，在产业生态系统内形成主体、资源、环境三要素协同循环，才能推动低空产业迈向更高台阶（李铁华、范志烁，2025；洪帅、吕荣胜，2017）。

从技术层面来看，核心技术“卡脖子”、产品服务成本高、公众接受度不高等问题的根源在于现阶段低空经济产业的技术水平不够成熟，无法解决产业链全自主、公众安全疑虑和低空边际成本高的问题。理论上，技术问题可以通过科技创新从资源要素中吸收技术、资金、人才来缓解上述问题所带来的发展困境。然而，单纯依靠科技创新难以系统性地解决上述问题。究其原因在于这类问题不仅是技术层面的挑战，更涉及产业链协同、科研设施完善、场景应用拓展与研发人才培养等多个维度。必须依靠技术端与产业端的深度融合，使得产业生态主体要素与产业资源要素形成畅通循环，才能推动低空经济实现从“研发”到“落地”的全面突破。具体而言，高端技术“卡脖子”问题表面看是个别高端技术的落后，但实际上还包含了高端产业生态不健全、配套体系不完善、成果转化机制不畅通等系统性障碍，其本质还涉及产业资源要素和环境要素循环不畅的问题。即便实现关键技术的突破，若缺乏成熟的产业链条、标准化的生产体系和稳定的市场需求支撑，技术成果往往难以真正落地。同时，如果产业端未形成有效的消费市场，技术层面的突破将无法获得持续的验证和反馈平台，难以形成良性持续的技术创新。只有通过技术创新与产业创新融合，打通从研发、试验、生产到商业化应用的全过程，才能有效推动核心技术的自主可控。

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从应用方面来看，当前低空经济的产业配套、基础设施建设滞后、商业模式不成熟等问题，根源在于产业尚处于初步探索时期，未来发展方向不够清晰，市场需求尚未充分激发，企业盈利模式单一，对政府补贴形成依赖。这导致产业端的制度设计和基础设施投入相对滞后，进一步制约了产业整体的发展水平。通过积极拓展低空应用场景、推进产业端的商业模式创新以培育市场需求，可逐步破解上述发展困境。例如：一是针对具体场景需求完善低空运行基础设施配套，避免基础设施建设的重复低效或缺位；二是在产业创新过程中探索可持续的商业运营模式和盈利路径，标准化未来低空产业的应用范围与服务模式；三是结合实际使用情况和企业诉求，制定配套的法律法规标准及明确的权责划分细则，补齐制度供给的短板。需要强调的是，产业创新不能脱离技术现实而盲目扩张，而应以现阶段低空科技的可行性为前提来规划创新路径。只有基于成熟可靠的技术条件推进产业模式创新，才能确保创新举措切实有效，避免陷入缺乏技术支撑的“纸上谈兵”（李牧南、谢天琪，2024）。

综上所述，当前制约我国低空经济发展的诸多深层次问题，看似单独集中在技术层面或产业层面，但本质上与这两个方面都息息相关。产业创新通过改善环境要素，可以使得主体要素拓展低空应用场景、重塑产业形态进而开拓市场需求、改变社会文化等，但如果没有科技创新提供关键技术突破和底层能力支撑，这些产业创新就难以发挥实效，甚至可能沦为“纸上创新”。同样，科技创新如果不能通过产业层面进行实践验证和机制转化，也难以实现技术价值的真正释放。因此，解决低空经济产业的发展困境必须协同推进科技创新与产业创新。只有这样，才能从根本上打通低空经济现阶段发展的瓶颈环节，实现产业生态的优化升级、商业模式的动态完善与市场空

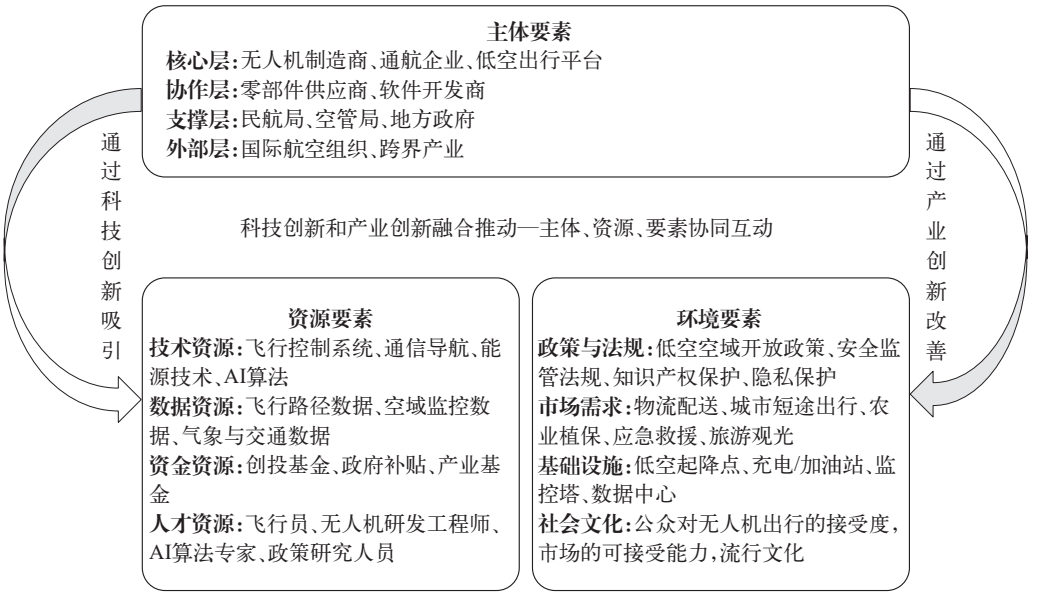

图3：低空经济产业高质量发展融合演进机制

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间的持续拓展。换言之，低空经济的高质量发展，离不开科技与产业的“双螺旋”式融合演进。

（二）推动低空经济产业科技创新与产业创新融合发展的政策建议

1.以试点城市为引领，因地制宜拓展低空经济应用场景

应用场景的成熟与规模化落地是科技成果转化为实际生产力的关键桥梁，而试点城市的路径探索和发展模式为低空经济相关应用场景的全域推广提供了经验模板和示范引领。中央空管委已初步确定合肥、杭州、深圳、苏州、成都、重庆六个城市开展eVTOL试点。民航局也发布了《民用无人驾驶航空试验基地（试验区）建设工作指引》，批准建立17个民用无人驾驶航空试验区和3个试验基地试点城市。试点城市或地区可以率先在商业模式、城市场景、基础设施、法律法规、安全监管等方面进行探索，率先突破体制机制瓶颈，为低空经济运营营造可预期、可执行的制度环境。在试点经验成熟并形成标准化流程后，可根据各地区资源禀赋和产业特色推广适配的应用场景，选择最具优势的细分领域开展示范运营。例如，北京、深圳等技术研发能力强的地区，应优先鼓励前沿技术攻关和标准制定；成都、重庆等人口密集和产业集聚的大城市可优先聚焦城市通勤、物流运输等场景；西安、洛阳等城市可凭借丰富的文旅资源，探索发展低空观光、无人机表演等新型文旅业态；西部地区可侧重地质勘探、灾害监测等领域；中原农业大省可试点智能农机与农业无人机作业。通过示范城市先行先试，形成可复制推广的模式，推动低空经济在全国范围内由“局部试点”走向“全域推广”。

2.培育多元创新主体，增强低空产业内生动力

科技创新与产业创新最终要落实到企业主体和专业人才上。应积极贯彻科教兴国战略和人才强国战略，壮大低空经济领域的创新人才和企业队伍。一方面，由政府设立低空经济专项基金或计划，支持以科技型中小企业为核心的创新主体发展。通过提供融资便利、税收减免、审批绿色通道等政策扶持，激发初创企业攻坚关键核心技术的主动性，培育一批拥有自主创新能力的行业领军企业。另一方面，鼓励高校设立低空经济管理、低空飞行器制造、智能控制、数据处理等相关学科专业，建设产学研融合的实训基地和联合培养机制，定向培养一批懂技术、善运营、通法规的复合型人才队伍。低空航线和应用场景普遍跨区域进行，故各地区还应加强人才和项目的协同流动，依托重点产业园区、自由贸易试验区等打造低空产业创新生态圈和区域联盟，促进人才、资本、技术高效汇聚。同时，积极吸引海外高层次人才参与低空经济技术攻关和标准研制，营造开放包容的产业创新环境，为低空经济注入源源不断的内生动力。

3.完善空域治理体系，加快构建低空经济监管体制

低空经济的健康发展有赖于安全规范、有序高效的治理环境。当前我国低空空域管理权限

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分散于军方和民航等多部门，审批流程复杂、周期较长，已成为制约科技成果落地和产业规模扩张的突出瓶颈。因此，建议由国务院层面牵头成立跨部门的监管机构，统筹军地空域资源管理，建立权责明确、反应高效的低空空域服务与监管体系。具体而言，在中央层面统一空域划设、飞行审批、运行监控和数据安全等核心事项管理，并在各省设立对应的低空空域监管机构，与国家发展改革委新设立的低空经济发展司相互配合，打破军方、民航等多头分管的碎片化格局。通过集中统一的监管体制，明确法规标准和监管流程，为低空经济的科技创新和产业创新融合发展提供制度保障。该监管机构还应发挥桥梁作用，推动政府、企业、科研单位的信息共享与标准共建，在飞行测试、运行示范等方面形成双向互动的创新机制，为低空经济高质量发展营造良好的政策和市场生态。

4.深化国际交流合作，拓展低空经济全球市场空间

低空经济具有技术密集、场景多元、产业牵引的突出特征，是各国竞相布局的未来产业高地。当前，欧美国家的通用航空产业发展更为成熟，在适航认证标准、空域管理规则、新型飞行器研发、航空发动机制造等方面已形成较为成熟的技术标准和监管体系。中国虽然在飞行器制造、新能源、通信导航、场景应用等方面具备一定优势，但在芯片、发动机等技术领域仍面临“卡脖子”瓶颈。为在新一轮竞争中掌握主动权，我国需要积极融入和影响全球产业规则制定。一方面，鼓励国内科研机构和龙头企业与国际一流科研单位、高科技企业开展联合研发和协同攻关，设立“低空经济国际联合实验室”或“全球低空科技创新基金”等合作平台，共同攻关下一代飞行器的核心技术和系统架构难题。另一方面，利用“一带一路”倡议等国家战略，建立多边的跨国科技合作机制，与金砖国家、欧盟等合作发起重大科技项目，共同制定低空经济技术标准，实现标准互认，增强我国在低空经济领域的规则话语权。

六、结论与展望

低空经济作为多领域前沿技术的复合型产业，既是当前新质生产力的典型代表，又是未来推动中国经济高质量发展的重要引擎。现阶段，我国低空经济已由“概念探索”逐渐转向“产业构建”，并在政策支持、技术突破和资本供给的多重驱动下展现出跨越式发展的势头。本文从发展历程、现状特征、增长动能、潜在优势以及现实挑战五个维度分析了当前我国低空经济的产业现状，并借鉴产业生态理论的研究视角提出以科技创新和产业创新深度融合为核心的产业发展路径和政策建议。低空经济作为我国培育新质生产力的重要方向，未来发展既面临前所未有的战略机遇，也遭遇多方面的现实挑战。唯有坚持科技创新与产业创新的双轮驱动，才能实现低空产业生态系统——主体、要素、资源三者的流畅互通，最终成长为支撑中国式现代化进程和全球竞争格

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局的重要战略性产业。

面向未来，中国低空经济的发展既要立足于国内需求，也要放眼全球竞争，呈现出以下几个值得关注的走向。一是低空经济有望成长为庞大的商业生态系统。未来的低空经济不再只是无人机、电动垂直起降飞行器等单一产品的市场化，而是一个由飞行器制造、智能空管系统、场景应用服务、法律标准制定等多环节共同构成的产业生态，并可能与人工智能、大数据、物联网等新兴技术协同演进，成为智能城市构建的重要支撑。二是低空经济将成为新一轮科技与产业竞争的战略高地。现阶段，欧美国家在传统通用航空建设、航空发动机与芯片等领域占据先机，而中国在新能源动力、通信导航上具备独特优势。随着规则体系尚未完全固化，低空经济的发展既是风险也是机遇。未来，中国若能在国际标准制定、核心技术突破和产业链主导权上占据主动，将可能在全球竞争中实现“弯道超车”，并通过“一带一路”等国际合作平台拓展市场空间，进一步增强我国产业的国际影响力。三是低空经济产业将深刻改变人类日常生活方式和社会治理模式。随着低空出行、空中物流、应急救援、环境监测、文旅体验等场景的开拓和日益普及，低空经济将从“小众试点”走向“大众应用”，逐渐融入居民的工作、生活与出行习惯。同时，低空经济在突发公共事件响应、城市治理现代化、绿色低碳转型等方面也将发挥重要作用，为提升国家治理体系和治理能力现代化水平提供新的工具与手段。

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China's Low-Altitude Economy: Theoretical Foundations, Development Status, and Policy Directions

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Abstract: *This paper delves into the evolution and defining traits of China's "low-altitude" economy and spotlights the powerful "triple engines" fueling its rise: Groundbreaking technological advancements, strategic policy support, and robust capital investment. However, despite its promise, the low-altitude sector grapples with significant hurdles, such as the risk of external coercive technological containment and sanctions, nonstandardized and underdeveloped infrastructure, untested business models, limited public acceptance, and lagging regulatory frameworks. Grounded in industrial ecosystem theory, this study analyzes the development model and real-world challenges of the low-altitude economy and argues that the seamless fusion of technological and industrial innovation is the linchpin for overcoming these obstacles. We propose bold policy recommendations across four key pillars: Amplifying pilot city initiatives, nurturing innovative enterprises and talent, fortifying regulatory and governance systems, and broadening international collaboration. By blending theoretical insight with actionable solutions, these strategies offer a clear and practical roadmap to propel the low-altitude economy toward a thriving, sustainable future.*

Keywords: *Low-altitude economy; Technological innovation; Industrial innovation; New quality productive forces*

JEL Classification Codes: O53; O31; O38

DOI: 10.19602/j.chinaeconomist.2025.11.03

1. Introduction

As a new wave of technological revolution and industrial transformation sweeps the globe, cutting-edge innovations in artificial intelligence, new energy, and the digital economy have begun to reshape traditional economic structures, heralding profound changes unseen in a century (Bai & Zhu, 2024). Against this dynamic backdrop and guided by Xi Jinping Thought on Economy, China has championed the deep integration of technological and industrial innovation. By leveraging major technological breakthroughs and addressing critical development needs, the nation aims to cultivate emerging strategic industries to forge new pathways for high-quality growth and accelerate the rise of new quality productive forces. In his article published in Issue 11 of *Qiushi* (2024), titled "Developing New Quality Productive Forces is an Intrinsic Requirement and a Key Focus for Promoting High-Quality Development", President Xi emphasized that "new quality productive forces are driven by innovation, breaking free from traditional models of economic growth and productivity development. They are characterized by high technology,

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Acknowledgement: Social Research Project of the Youth Humanities and Social Sciences Research Center, Chinese Academy of Social Sciences, "Research on Constraints and Optimization Strategies for Low-Altitude Infrastructure Construction" (Grant No. 2026QNZX028).

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high efficiency, and high quality, embodying the advanced form of productivity aligned with the new development philosophy". The low-altitude economy is a primary example of these new quality productive forces, seamlessly integrating aviation technology, intelligent control, communications, navigation, and new energy. Born from scientific breakthroughs and innovative business models, this multifaceted sector aligns with China's strategic priorities and has rapidly emerged as a trillion-yuan powerhouse, fueled both by technological innovation and its inherent transformative potential (Ni et al., 2025). Recognized as a strategic emerging industry at the 2023 Central Economic Work Conference and designated a new growth engine in the 2024 *Government Work Report*, the low-altitude economy has enjoyed robust support from the Communist Party of China (CPC). Building on the foundation of traditional general aviation, it incorporates advanced technologies such as drones, intelligent control systems, and satellite navigation to create a cutting-edge, technology-driven production and service ecosystem.

Although China's low-altitude economy is still in its early stages, with market demand yet to be fully unleashed, its future seems to be brimming with potential. The Civil Aviation Administration of China (CAAC) projects that the market size will soar to 3.5 trillion yuan by 2035[1]. Far from operating in isolation, the low-altitude economy spans diverse sectors, including energy, transportation, manufacturing, agriculture, and logistics, thereby fostering a vibrant new pattern of cross-industry collaboration. Looking ahead, the sector is poised to evolve into a dynamic, composite industrial system driven by "multi-industry synergies and diverse application scenarios". By embedding itself in traditional industries, nurturing future-oriented sectors, and generating powerful spillover effects, the low-altitude economy can integrate upstream and downstream industries, unlock broader market applications, and foster integrated development across industrial chains to tap a broad spectrum of market applications.

The development of the low-altitude economy is not the result of a single company's actions. Instead, it is an emerging industrial system where diverse players, including companies, government bodies, research institutions, and financial organizations, interact and collaborate through the exchange of knowledge, technology, and capital in a dynamic environment of symbiosis, evolution, and shared value creation. Within this industrial ecosystem, the key actors are companies, government bodies, users, and research institutions, and the essential resources are technology, funding, data, and talent. In addition, the economic environment is shaped by policies, regulations, market demand, infrastructure, and social culture. Industrial ecosystem theory holds that an industry's prosperity depends on its ability to continuously engage in positive interactions with its surrounding environment and resources. By creating and exchanging value, the low altitude sector can strengthen its position within the broader ecosystem (Lou & Yu, 2009). From this viewpoint, the rapid development of the low-altitude economy is a result of its ability to draw "nutrients" from its ecosystem's resources and environment. For example, low-altitude aircraft use advanced technologies such as carbon fiber composites and intelligent coatings to improve endurance and aerodynamic performance. With policy support, innovative aircraft such as electric vertical take-off and landing (eVTOL) vehicles have begun to be piloted in various regions, showcasing the future of urban air mobility. A substantial influx of capital has also enabled deep integration between the low-altitude economy and many other fields, giving rise to new business models and service formats. This has driven the development of new aircraft such as drones, which are now widely used in industries, including logistics, tourism, agriculture and forestry, and emergency rescue.

With China's progressive airspace management reforms and low-altitude pilot programs, the low-

[1] Source: Ministry of Transport of the People's Republic of China, "Low-Altitude Economy Accelerates Takeoff," March 6, 2025, https://www.mot.gov.cn/jiaotongyaowen/202503/t20250306_4165146.html.

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altitude economy has also begun to emerge as a new, distinct industrial sector from the traditional general aviation industry. This rise represents both a technological restructuring and a paradigm shift, offering a new opportunity for the deep integration of technological and industrial innovation. From a technological standpoint, the low-altitude economy integrates a new generation of information technologies, such as 5G communications, BeiDou navigation, and artificial intelligence, with cutting-edge engineering technologies such as novel composite materials, motor and electronic control systems, and aircraft miniaturization. This has broken down the barriers of fragmented, uncoordinated traditional innovation models to establish a cohesive ecosystem of technologies, platforms, and applications. This robust technical foundation provides solid support for industrial development and enables the seamless connection of key actors and resources within the low-altitude industrial ecosystem (Ouyang, 2025). From an industrial innovation perspective, the low-altitude economy has spurred deep collaboration across various sectors, including agriculture, manufacturing, services, and public administration, that has led to a continuous stream of new application scenarios (Zhao, 2025). By creating value through low-altitude services and using new scenarios as innovation testbeds, the sector facilitates policy implementation and meets market demand, linking the ecosystem's key actors with its environmental elements. The low-altitude economy is more than a newly emerging industry, it is a pivotal force poised to reshape the landscape of synergistic technological and industrial innovation that offers a strategic opportunity for China to forge new paths to leadership in emerging strategic sectors.

This paper examines the development history and current characteristics of China's low-altitude economy and presents an in-depth analysis of its drivers of growth, potential advantages, and practical challenges it faces in achieving "high-quality" development. Unlike other emerging industries such as new energy vehicles and cloud computing, the low-altitude economy, as a multi-technology converged sector, is characterized by diverse yet highly uncertain application scenarios. It remains unclear in which specific scenarios and through what models it will achieve scaled development in the future. We argue that the fundamental path for the low-altitude economy's development must be the integration of technological and industrial innovation and propose that a deep fusion of these two forms of innovation is the key to overcoming current bottlenecks. Our primary contribution is to build a theoretical framework for the "high-quality" development of the low-altitude economy from this integrated perspective and to provide concrete policy recommendations.

2. The Evolution and Defining Features of China's Low-Altitude Economy

2.1 Evolution of China's Low-Altitude Economy

The development of China's low-altitude economy has progressed through three distinct phases: nascent exploration, initial development, and rapid growth (see Figure 1).

Pre-2010: The Nascent Exploration Phase. During this period, China's aviation industry was centered on traditional general aviation. The term "low-altitude economy" had not yet been formally recognized, and related technologies were still in their infancy. Airspace management was highly centralized under military control, and cumbersome flight approval processes severely limited the growth of civil general aviation. Consequently, the sector primarily served public good or utility applications such as agricultural and forestry protection, aerial photography, and meteorological observation, with very limited commercial or civilian applications.

The period from 2010 to 2020 marked the initial development stage of the low-altitude economy industry. During this phase, significant breakthroughs were made in academic research, technological innovation, and policy support. Academic Research: Starting in 2010, the concept of the "low-altitude

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economy" was first introduced and discussed within Chinese academic circles, gradually gaining public attention[2]. Technological Innovation: The rapid breakthrough of low-altitude aircraft, particularly drones, along with their integration with emerging technologies such as BeiDou navigation and 5G communications, accelerated the expansion of commercial applications. This led to significant growth in fields such as aerial mapping and surveying, agricultural plant protection, environmental monitoring, and disaster rescue (Ni et al., 2025). Policy Support: The CPC Central Committee and the State Council issued a series of policy documents to encourage the exploration and opening of low-altitude airspace resources. In 2010, the State Council and the CPC Central Military Commission jointly released the *Opinions on Deepening the Reform of Low-Altitude Airspace Management in China*, which proposed a three-phase strategy of pilot programs, broader promotion, and deepening reforms. In 2016, the General Office of the State Council issued the *Guiding Opinions on Promoting the Development of the General Aviation Industry*, which explicitly called for the further opening up of low-altitude airspace, optimizing flight services, and streamlining approval processes to create a favorable policy environment for the industry's

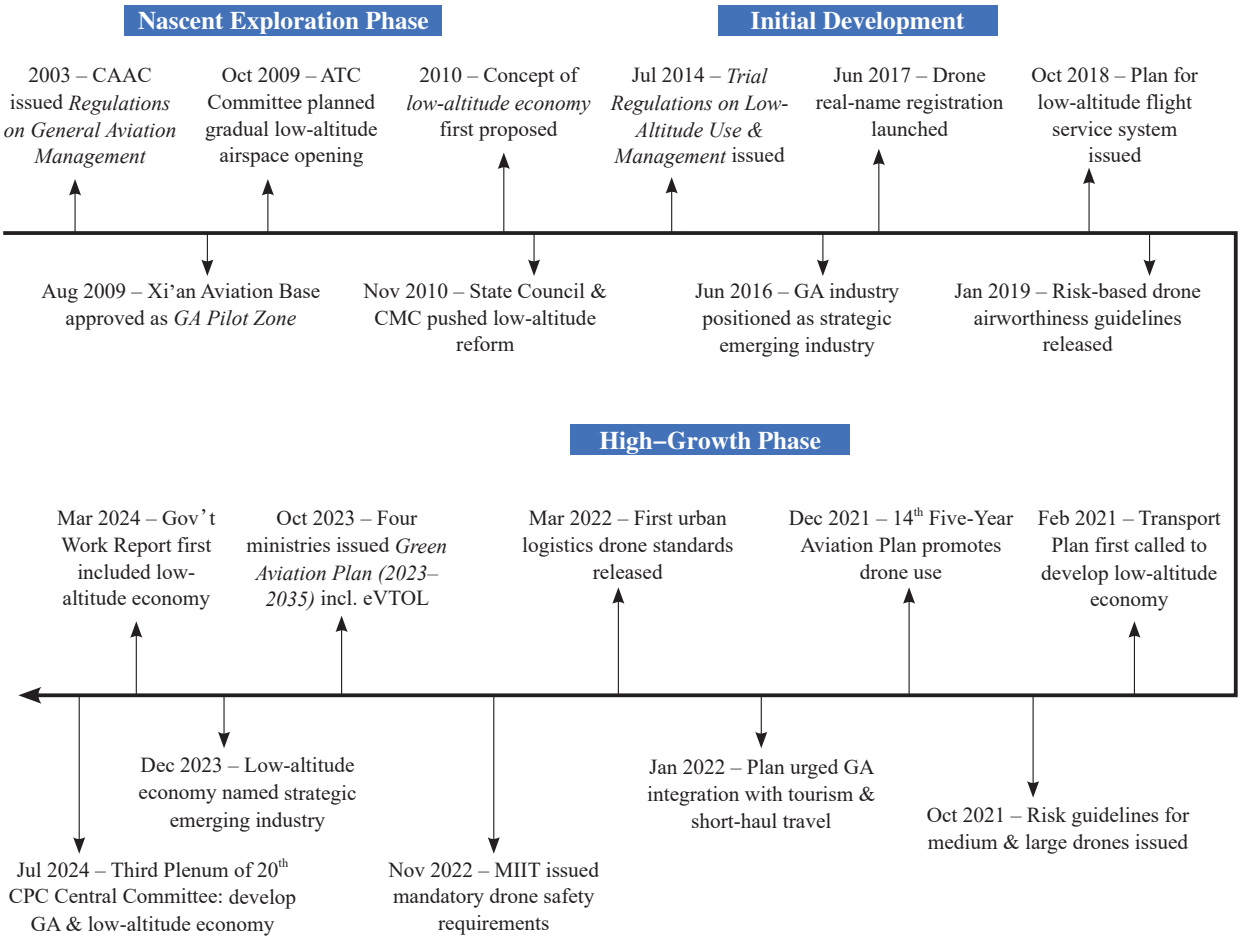

Figure 1: Development Timeline of China's Low-Altitude Economy

[2] Source: Jiangsu Science and Technology Think Tank, *A Review of the Development of China's Low-Altitude Economy and Related Industry Policies*, May 16, 2024, https://www.skzlyjy.org.cn/web/artlist/360.

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development.

Since 2021, China's low-altitude economy industry has entered a stage of rapid development. Driven by supportive government policies, technological breakthroughs, and substantial capital investment, what was once an extension of traditional general aviation has transformed into a strategic, standalone industry. The shift to a national priority was marked in February of 2021, when the CPC Central Committee and the State Council issued the *Outline of the National Comprehensive Three-Dimensional Transportation Network Plan*, officially designating the low-altitude economy as a national strategic industry and setting clear goals for its development. Years of technological progress and market exploration paved the way for explosive growth. The data underscores this remarkable progress. The number of registered drones nationwide surged by over 60% in a single year, from 517,000 in 2020 to 832,000 in 2021 and has continued to grow at an annual rate in excess of 45%. The number of licensed drone operators has also increased significantly, rising by more than 35% from 89,000 in 2020 to 120,800 in 2021. By the end of 2024, China had 2.177 million registered drones, 1.619 million registered drone owners, 273,300 licensed operators, and a total of 26.667 million flight hours logged for the year, demonstrating that the low-altitude economy was not just taking shape, but taking off[3].

In December of 2023, the Central Economic Work Conference explicitly designated the sector as a national strategic emerging industry, and in 2024, the Government Work Report identified the low-altitude economy as a "new growth engine" for the first time. Later that year, the Third Plenary Session of the 20th CPC Central Committee emphasized the need to develop general aviation and the low-altitude economy. The 2025 Government Work Report further underscored its importance, calling for the "safe and healthy development" of emerging industries, including commercial aerospace, the low-altitude economy, and deep-sea technology. Provincial and municipal governments have increasingly incorporated the low-altitude economy into their work reports and have consistently introduced dedicated development plans. This nationwide push, combined with sustained interest from capital markets and the establishment of a dedicated Low-Altitude Economy Development Department under the National Development and Reform Commission (NDRC), demonstrates that policy support is intensifying. The path forward for the low-altitude economy is becoming increasingly clear, with growing momentum driving the industry toward a vibrant future.

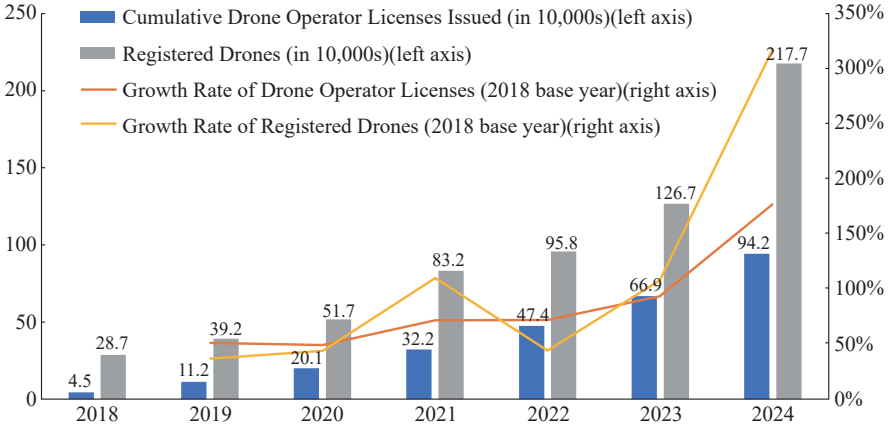

Figure 2: Growth of the Drone Industry (2018–2024)

Source: Compiled by the authors based on the *Civil Aviation Industry Development Statistics Reports* (2018–2024).

[3] Source: Compiled by the authors based on the *2024 Statistical Bulletin on Civil Aviation Industry Development*.

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2.2 Defining Features of the Low-Altitude Economy

At this stage, China's low-altitude economy has established a solid foundation for achieving large-scale, regular, and sustainable development. As a crucial component of strategic emerging industries and a hallmark representative of new quality productive forces, it has rapidly transitioned from the pilot demonstration phase to widespread commercial application. With its expanding business scope and growing range of use cases, the sector is demonstrating innovative characteristics that set it apart from traditional general aviation.

From an innovation perspective, the low-altitude economy leverages information and digital technologies to expand its application scenarios, giving rise to new industry paradigms and business models (Wang & Ni, 2024). Beyond simply replacing traditional general aviation for tasks such as logistics, agricultural protection, and emergency rescue, the widespread use of information technology in drone swarms has enabled new "low-altitude+" business models. This has created innovative services such as aerial performances, cultural tourism experiences, and live streaming from above, which have significantly broadened the industry's boundaries. Additionally, as piloted flight technologies such as electric vertical take-off and landing (eVTOL) aircraft mature, the low-altitude economy shows immense potential for point-to-point urban commuting. Unlike traditional aircraft that require long runways, eVTOLs can take off and land on rooftops or in small spaces at the edge of a city. This makes them an ideal fit for densely populated urban environments.

Technological innovation within the low-altitude economy is characterized by three key features. (1) Technological Integration: The low-altitude economy integrates cutting-edge technologies from multiple fields to form a comprehensive and sophisticated innovation system. In manufacturing, advanced technologies such as lightweight composite materials, new corrosion-resistant coatings, electric propulsion systems, and high-energy-density batteries are widely used to significantly improve aircraft safety, stability, and endurance. (2) System Coordination: Relying on advanced software and hardware, such as low-altitude airspace management systems, digital twin platforms, and integrated air-to-ground communication links, aircraft can achieve highly efficient coordination with each other and with ground control systems. This significantly enhances the safety and regulatory efficiency of multiple aircraft operating simultaneously. For example, a low-altitude airspace management system ensures that multiple aircraft can operate without collisions or conflicts and are fully traceable through functions such as aircraft identity authentication, flight approval, airspace designation, trajectory tracking, and collision warnings. (3) Intelligence: Thanks to the widespread use of infrared detectors and LiDAR, along with AI algorithms and big data analytics, modern low-altitude aircraft have transitioned from manual control to autonomous systems. These systems have the ability to "[intelligently] perceive, autonomously decide, and collaboratively execute" on their own. Once a mission objective is set, the aircraft can make independent decisions, reducing reliance on remote human operation and improving flight stability and mission execution in complex environments.

3. Growth Drivers and Potential Advantages of China's Low-Altitude Economy

As an emerging strategic sector, the low-altitude economy's development has been a phased expansion from localized pilot programs to a nationwide, scalable industrial system with sustained growth. However, as a complex industry at the intersection of policy, technology, and market forces, its growth and adoption are highly uncertain and intricate. Grasping the underlying logic of its evolution requires a deep understanding of the sector's growth drivers. This knowledge is essential for crafting

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targeted policies and planning future industrial layouts to guide the low-altitude economy from scattered trials to widespread adoption. This section, based on the current state of China's low-altitude economy, outlines its core growth drivers and further discusses the country's potential advantages in developing the industry while considering its specific national context.

3.1 Growth Drivers of the Low-Altitude Economy

The rise of the low-altitude economy is the result of multiple factors working in concert, driven by a combination of historical opportunity and market necessity. Technological breakthroughs, policy guidance, and capital investment are the three core drivers that have propelled the low-altitude economy from its initial launch into a phase of sustained acceleration.

3.1.1 Technological breakthroughs as the primary driver

The low-altitude economy is fundamentally a technology-driven industry. Its development is highly dependent on the innovation and integration of key technologies, and it is precisely these scientific and technological breakthroughs that have made the low-altitude economy a reality. From a value chain perspective, every segment, from upstream aircraft manufacturing and midstream control and scheduling to downstream mission execution and applications, relies on technological progress. For example, in the case of drones, the use of new materials and high-energy batteries has solved previous issues of flight safety and endurance, turning the concept of aircraft manufacturing into a reality. Furthermore, the application of 5G communications and BeiDou navigation has enabled in-air information exchange and precise positioning, overcoming the limitations of traditional aviation CNS (Communication, Navigation, Surveillance) systems or radar, and allowing for real-time sensing, rapid dispatch, and mid-air collision avoidance. Additionally, thanks to computing advancements and artificial intelligence (AI), aircraft can now be simulated in virtual systems and develop autonomous decision-making capabilities through self-learning. This has dramatically expanded the range of aircraft applications. Without this complete technical framework, it would be difficult to ensure high-density, safe, and orderly low-altitude operations, posing significant public safety risks. For this reason, technological breakthroughs are the foundational and primary condition for the industry's growth and serve as the essential prerequisite for all low-altitude economic applications and business model innovations.

3.1.2 Policy guidance is the key accelerator

The low-altitude economy is not just a high-tech sector, it is also a high-risk, high-investment industry that relies heavily on a robust institutional framework. The industry faces systemic challenges, including building infrastructure, securing airspace, ensuring flight safety, conducting meteorological assessments, and navigating a complex regulatory framework. Relying on market forces alone to solve these issues would be slow, inefficient, and, in many cases, impossible. This is where government policy steps in, acting as both a catalyst for progress and a crucial safety net. As a vital national asset, low-altitude airspace needs clear rules on how it is used, opened, and regulated to ensure safe and sustainable development. In recent years, a flood of supportive policies from central and local governments, such as the *14th Five-Year Plan for General Aviation Development* and the *Interim Regulations on Unmanned Aircraft Flight Management*, has unlocked airspace for commercial use and boosted market confidence. Beyond regulatory support, the industry also requires massive investments in infrastructure, including airports, communication towers, and monitoring platforms. These projects are expensive, time-consuming, and offer low short-term returns, making them potentially unsustainable for private companies alone. By launching pilot programs and industry incubators, local governments have

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significantly lowered the barriers to entry for businesses, speeding up project rollouts and fueling growth across the entire supply chain. It is for these reasons that governmental guidance has been a major driving force behind the low-altitude economy's rapid rise.

3.1.3 Capital supply as a powerful catalyst

As China's economy transitions away from traditional, energy-intensive, high-leverage, and labor-intensive sectors, its capital is actively seeking new avenues for growth, and the low-altitude economy has emerged as a prime target due to its high-tech nature, extensive value chain, and deep integration with AI and new energy. This influx of capital provides three key boosts to the industry's rapid ascent. (1) Easing Financial Bottlenecks: For startups, capital provides a lifeline during the capital-intensive phases of technology development, prototype testing, and business model validation. This funding allows companies to build technological moats, accelerate the development of core hardware and software, and shorten their time to market. It also gives them the financial runway to explore sustainable business models in areas like logistics, tourism, and urban air mobility, speeding up the industry's commercialization. (2) Raising Visibility and Sparking Policy Action: Investments from prominent funds and industrial giants have put the low-altitude economy in the national spotlight, attracting media attention and prompting a positive policy response from local governments. Cities including Shenzhen, Chengdu, and Suzhou have responded by creating their own industry plans and establishing multi-billion yuan special funds to support local businesses and build pilot airspaces. (3) Strengthening Resilience: In a fast-evolving market, a large supply of capital is not just about survival, it is about gaining a crucial "time window" Well-funded companies can weather initial losses, focus on tackling key technical challenges, and launch pilot operations to get through the industry's early "winter" phase. Projects with capital backing also tend to get government pilot licenses more easily, which accelerates the entire development process.

3.2 China's Advantages in Advancing the Low-Altitude Economy

The low-altitude economy sits at the critical intersection of multiple frontier technologies, positioning it as a key driver for nurturing "new quality productive forces". It is also a crucial force for transforming transportation, modernizing emergency response, and building smart cities. In recent years, the Chinese government has recognized this immense opportunity and elevated the low-altitude economy to an emerging strategic industry. By coordinating policy, technology, funding, and market development, the government aims to guide the industry from its exploratory phase to an orderly expansion. In this effort, China's institutional strengths, vast market size, and robust industrial base collectively form a unique advantage for fostering the "high-quality" development of the low-altitude economy (Ni & Wang, 2025).

3.2.1 A super-sized market that offers a dual dividend of demand and talent

According to the data from the Seventh National Population Census, China's population was approximately 1.408 billion in 2022. This enormous population creates a dual dividend of consumer demand and talent supply, which are critical for the low-altitude economy's future growth. A huge population base means a vast consumer market. As China's middle-income group expands, consumer behaviors and purchasing power continue to evolve. For the urban middle-income group in particular, personalized, convenient, and highly efficient services have become a priority. For example, drone delivery improves the speed and convenience of traditional logistics, and eVTOL passenger transport offers a faster and more efficient way to commute within cities. These applications may serve a market

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of over a billion people, providing a vast "blue ocean" for companies to pursue commercialization and large-scale operations. However, the massive population also provides an abundant supply of talent, forming a solid foundation for the low-altitude economy's long-term, "high-quality" development. According to the Ministry of Education, China admitted 1.3568 million graduate students in 2024, including 171,100 doctoral students and 1.1857 million master's students. In the same year, the total number of students enrolled in graduate programs reached 4.0954 million, with 676,300 doctoral students and 3.4192 million master's students[4]. This vast talent pool can act as a "reservoir" for the future development of the low-altitude economy, ensuring that the industry not only has a sufficient workforce but can also leverage specialized skills to drive the entire development chain, from technological research to industrial implementation. Thus, China's population size signifies not only a huge market potential on the demand side but also a talent resource advantage on the supply side. This "dual dividend" represents a highly strategic, endogenous driver that gives China a unique advantage in the development of its low-altitude industry.

3.2.2 A well-established industrial chain as a foundation for growth

The low-altitude economy is a dynamic new sector that blends aerospace, new energy, communications and navigation, artificial intelligence, and other cutting-edge fields, and its success hinges on seamless collaboration and synergy between upstream and downstream players. China boasts the world's most comprehensive industrial chain, which covers 41 major categories, 207 medium categories, and 666 subcategories of production capacity. This vast network gives China a global edge in critical areas such as batteries, composite materials, navigation systems, and drone manufacturing. It also enables the smooth integration and practical use of these technologies in low-altitude applications. Beyond that, this well-rounded industrial ecosystem has fostered a thriving community of mature small and medium enterprises (SMEs) as well as support suppliers. These players deliver reliable services across the value chain, spanning aircraft design, manufacturing, R&D, testing, and maintenance. With such a broad manufacturing base and sophisticated supply chain, China can support every stage of the low-altitude economy's lifecycle, from initial design and production to downstream use. This speeds up the shift from "concept" to "real-world" and allows companies to adjust product designs and service offerings swiftly to meet market needs. In addition, a fully integrated industrial chain delivers significant cost benefits. By leveraging its robust manufacturing foundation, established supply networks, and advanced logistics, China can tap into economies of scale that drive down industry-wide costs, giving it a clear competitive advantage on the global stage.

4. Real-World Challenges in Developing a "High-Quality" Low-Altitude Economy

Driven by strong policy support, technological breakthroughs, and market demand, China's low-altitude economy has rapidly expanded to establish a presence across various regions. It stands as a prime example of how the fusion of technological and industrial innovation can cultivate new quality productive forces. However, with this rapid growth come numerous structural and institutional challenges. Clearly identifying and analyzing these real-world obstacles is crucial not only for guiding the development of the low-altitude economy but also for effectively linking the innovation chain with the industrial value chain.

[4] Source: *Statistical Bulletin of National Education Development in 2024*.

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4.1 The Risk of Coercive Sanctions on Key Technologies

Thanks to its robust industrial base and comprehensive manufacturing system, China has made significant progress in drone manufacturing and flight control systems. It has achieved independent design and production for most low-altitude aircraft components, and many of its technologies are among the world's leaders. However, China still relies on imports for some high-end core components. This dependence leaves the low-altitude economy vulnerable to sanctions and coercive measures from other countries, posing three key risks to its long-term development. First, heavy reliance on high-performance aviation components: Despite major advancements in its aviation industry, China still lags behind global leaders in areas such as aircraft engines and flight control systems. Core technologies in these fields remain heavily dependent on imports (Zhang & Huang, 2024). Second, lack of autonomy in high-end flight control chips: The future of low-altitude aircraft lies in their integration with artificial intelligence, which demands increasingly powerful and stable computing and control chips. Currently, China has a significant manufacturing gap in high-end flight control chips, preventing full self-reliance. This could constrain the sustainable development of the industry over the long term. Third, gaps in precision mapping and intelligent sensors: China still trails behind more advanced nations in technologies such as high-precision mapping and intelligent sensors. Many widely used high-precision radar systems and sensors rely on mature foreign products, and the domestic substitution rate remains low. A potential supply cutoff could pose a serious threat to the safety of low-altitude flight in China (Zhang & Huang, 2024).

4.2 Slow and Uneven Development of Supporting Infrastructure

The development of China's low-altitude economy has been hampered by slow infrastructure construction and a lack of standardized norms. The total number of physical infrastructure facilities is low, their regional distribution is imbalanced, and construction standards are inconsistent. At the end of 2024, China had only 475 registered general aviation airports, a stark contrast to the 19,482 general airports in the United States (which includes 5,146 public and 14,336 private airports)[5]. Most of China's airports are concentrated in the eastern coastal and economically developed regions. In contrast, central, western, and remote areas, which have abundant airspace resources and a wide range of potential applications, have very limited airport coverage, making it difficult to support a wide-area, continuous low-altitude service network. In terms of layout, existing infrastructure often suffers from a lack of clear hierarchy, overlapping functions, and dispersed locations, leading to low operational efficiency and poor resource allocation. Furthermore, the development of new infrastructure, such as eVTOL takeoff and landing pads, fueling stations, and weather stations, has been sluggish. Even in provinces and cities that have initiated planning and bidding for low-altitude infrastructure, the lack of unified construction standards has hindered project implementation. This, to a certain extent, restricts the application scenarios and market expansion of the low-altitude economy. However, there are also shortcomings in software infrastructure. Critical support systems, such as geographical information services and airspace monitoring platforms, are still underdeveloped. The lack of data standards and inconsistent system interfaces across different regions makes it difficult to achieve seamless integration and interoperability between hardware and software, hindering the efficiency and regional collaboration of the low-altitude industry.

4.3 Immature Business Models and Narrow Profit Pathways

The low-altitude economy, although spanning fields from general aviation, drone logistics to urban

[5] Source: Federal Aviation Adminstration, "Air Traffic By The Numbers," July 30, 2025, https://www.faa.gov/air_traffic/by_the_numbers.

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air mobility, remains largely in an exploratory phase. Most companies operate without a mature business system or a clear path to profitability, leaving the industry's future direction uncertain and its financial returns weak. Many general aviation and drone firms today remain dependent on local fiscal support, project funding, and policy dividends and have yet to develop self-sustaining capabilities. If policy support or funding were to slow down, some companies could face significant operational challenges, making it difficult to maintain long-term viability. Furthermore, some pilot projects, such as low-altitude tourism, are overly dependent on unique local environments. For example, a "drones + cultural tourism" model is suitable for cities with rich historical sites or a beautiful landscape. Without a standardized service model, however, these projects cannot be easily replicated in other regions, which severely limits the industry's ability to scale and expand nationwide.

4.4 Low Public Acceptance and Untapped Market Demand

From a user perspective, the low-altitude economy faces a major obstacle: lack of public acceptance. Potential market demand has yet to be translated into actual consumer spending, becoming a key bottleneck for the industry's high-quality development. First, the public still has doubts about the safety of low-altitude aircraft. Unlike traditional, familiar civil aviation, these new vehicles are unproven to many. Public doubts about their stability and safety can create fear and distrust, making consumers less willing to use them. Second, the high cost of services presents a major barrier. Current low-altitude applications, such as urban air taxis and drone logistics, often come with a high price tag. Although they offer a clear advantage in saving time compared to traditional methods, they lack a price advantage, making them a luxury rather than an accessible option for the public. Additionally, daily use cases are still limited. Most low-altitude services are currently one-time experiences, far from being a part of daily life, and current low-altitude aircraft are still vulnerable to adverse weather, which renders them unable to provide the all-weather, all-day service that consumers have come to expect for logistics and commuting. This limits the industry's dynamism and broad appeal.

4.5 Legal and Regulatory Frameworks Lag Behind Market Needs

As the low-altitude economy evolves from traditional general aviation into a distinct, emerging industry, a significant disconnect has also emerged between its rapid growth and the existing legal and regulatory frameworks. These outdated rules have failed to keep pace with the regulatory needs of new technologies and business models. The expansion of the low-altitude sector has brought to the forefront urgent issues such as airspace security, privacy violations, and data sovereignty (Chen, 2025). However, current laws such as the *Civil Aviation Law of the People's Republic of China* and the *General Aviation Flight Control Regulations* lack clear guidelines and regulatory tools to address these challenges. Furthermore, the legislative landscape is "fragmented" and lacks "sufficient authority" (Jiang & Feng, 2025). Without clear guidance, this ambiguity can lead to unclear responsibilities and lack of clear legal basis for recourse for both businesses and the public in case of disputes, increasing the risk for companies engaged in low-altitude flight, logistics, or aerial tourism. Regulatory oversight has also lagged. There are no clear, enforceable rules to govern the rapid rise of emerging technologies and industries such as drones and eVTOLs. Although some local governments have launched pilot projects, the overall system lacks top-down design and unified standards, which has led to inconsistent rules and fragmented policies across different regions. For example, the approval process for large low-altitude

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aircraft such as flying cars remains cumbersome and inefficient. Finally, a lack of regulatory capacity and technological tools presents another major challenge. The low-altitude sector involves a wide range of mobile products and operations, which demands real-time weather monitoring, risk warnings, and precise flight control. However, the current low-altitude air traffic management system has significant shortcomings in terms of radar coverage, data sharing, and personnel training, creating potential safety and oversight risks.

5. Integrating Tech and Industry to Boost the Low-Altitude Economy

5.1 Tackling Development Challenges through Tech and Industry Innovation

After years of rapid growth, the low-altitude economy has emerged as a powerful new driver for economic progress in China. Yet, this rapid rise has also laid bare some deep-rooted challenges. On the tech front, hurdles include "choke points" in core technologies and the steep costs of products and services. On the application side, issues range from incomplete infrastructure and untested business models to low public buy-in and outdated legal and regulatory systems. Looking through the lens of industrial ecosystem theory, these obstacles fundamentally boil down to how the ecosystem's core components, players, resources, and the surrounding environment, interact, adapt, and evolve. This theory suggests that neither tech breakthroughs nor industrial innovations alone can fully tackle the industry's current roadblocks. The real solution lies in deeply blending technological and industrial innovation, creating a cohesive cycle among ecosystem players, resources, and conditions to elevate the low-altitude sector to new heights (Li & Fan, 2025; Hong & Lv, 2017).

From a technical perspective, challenges such as core technology "choke points", high service costs, and limited public acceptance stem from the sector's immature technological foundation. This immaturity leaves the industrial chain short of full independence, fails to ease public safety worries, and keeps the marginal costs of low-altitude services high. In theory, tech innovation can tap into resources including funding, talent, and expertise to ease these pressures. But tech alone cannot fix everything; problems also tie into industrial coordination, research support, real-world applications, and workforce development, which go beyond pure technical fixes. This calls for a tighter fusion of technological and industrial efforts to ensure a smooth flow between ecosystem players and resources. Only then can the low-altitude economy break through barriers, from "R&D to market deployment". Take the issue of advanced technology bottlenecks, for example. It might seem like a narrow tech delay, but is really a symptom of bigger systemic issues: an immature high-end industrial ecosystem, patchy supporting infrastructure, and weak links between research and market-ready products. Even when breakthrough tech emerges, without a solid industrial chain, standardized production, and steady market demand, it often fails to take off in practice. Similarly, if the industrial side fails to build a strong consumer base, tech advances lack a stage for continuous testing and feedback, stalling further innovation. The path forward thus lies in weaving technological and industrial innovation together, connecting every step from research and testing to production and sales. This approach ensures control over core technologies and paves the way for the low-altitude economy's sustainable growth.

From an application perspective, the challenges facing the low-altitude economy stem from its early exploratory phase. The industry's future direction is still murky, market demand has yet to fully kick in, and some companies rely on few revenue streams, including policy support, to stay afloat. This has led to delayed institutional planning and insufficient infrastructure investment, further holding back overall

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progress. These hurdles can be tackled by actively broadening low-altitude use cases and sparking innovation in industrial business models to ignite market interest. For instance, we advise China's government to boost supporting infrastructure by tailoring facilities for low-altitude operations to specific needs, thereby avoiding wasted resources and gaps from redundant construction. We also advise it to promote sustainable business models by identifying new profit pathways during industrial innovation, standardizing application scopes and service models to shape the future of the sector. It should also strengthen legal and regulatory frameworks to develop clear rules on rights and responsibilities, aligned with real-world usage and business needs, to plug institutional gaps. That said, industrial innovation should not race ahead without considering technological limitations. The path forward must be built on the current feasibility of low-altitude technologies. Only by rooting business model innovation in mature, reliable tech can these efforts deliver real results and avoid becoming "paper innovation" (Li & Xie, 2024).

At first glance, the deep-rooted issues holding back China's low-altitude economy might seem to reside in either technology or industry alone. But in reality, those issues are tightly interwoven. Industrial innovation can reshape the landscape by improving the ecosystem's environment. Yet, without breakthroughs in key technologies and the foundational support they bring, these efforts risk falling flat or becoming "empty innovation". However, technological advances without industrial validation and institutional backing cannot unlock their full potential. Tackling these challenges requires a synchronized push in both technological and industrial innovation. This dual approach is the only way to break through current bottlenecks, fine-tune the industrial ecosystem, refine business models, and unlock lasting market growth. In essence, the development of the low-altitude economy hinges on a "double-helix" evolution in which tech and industry innovation twist together to drive progress forward.

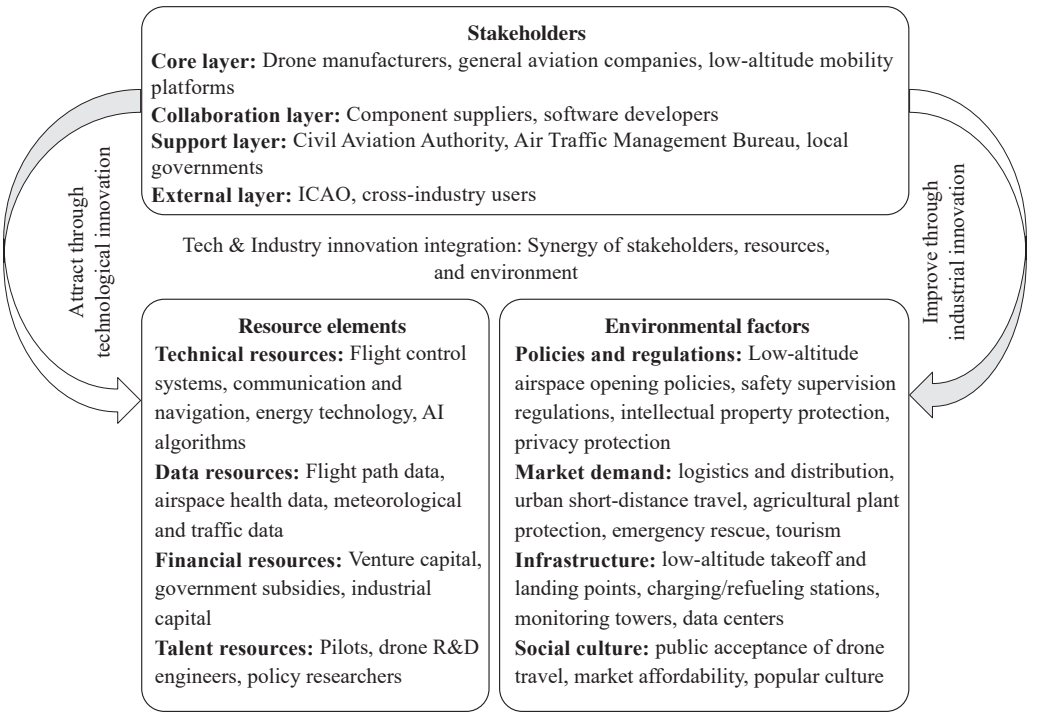

Figure 3: Integrated Paths to High-Quality Development of the Low-Altitude Economy

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5.2 Policy Recommendations for the Low-Altitude Economy

5.2.1 Pioneering growth with pilot cities

The maturation and large-scale adoption of application scenarios are crucial for turning technological breakthroughs into real-world productivity. Pilot cities, in this sense, can act as trailblazers, providing a template for nationwide adoption of low-altitude solutions. The Central Air Traffic Management Committee has already designated six cities as initial eVTOL pilot sites: Hefei, Hangzhou, Shenzhen, Suzhou, Chengdu, and Chongqing. The CAAC also issued the *Guidelines for the Construction of Civil Unmanned Aviation Test Bases (Test Zones)*, approving 17 test zones and 3 test bases. These cities and regions can lead the way in exploring business models, urban applications, infrastructure, legal frameworks, and safety regulations. By being the first to break through institutional bottlenecks, they can help to create a predictable and enforceable regulatory environment for the low-altitude economy. Once pilot programs mature and standardized processes are established, tailored application scenarios can be promoted based on each region's unique resources and industrial strengths. The most promising sub-sectors can then be chosen for demonstration operations. For instance, Beijing and Shenzhen, with their strong R&D capabilities, can focus on pioneering cutting-edge technologies and setting industry standards. Chengdu and Chongqing, as populous urban centers, can prioritize applications such as urban commuting and logistics, and Xi'an and Luoyang, with their rich cultural and tourism resources, can explore new business models such as low-altitude sightseeing and drone light shows. China's western regions can focus on geological exploration and disaster monitoring. Moreover, agricultural provinces in China's Central Plains can pilot smart agricultural machinery and drone-assisted farming. By using this "pilot first, then scale" strategy, cities can create replicable models that accelerate the low-altitude economy's transition from "local trials" to "nationwide adoption".

5.2.2 Building a diverse low-altitude innovation ecosystem

The ultimate success of technological and industrial innovation depends on both companies and skilled professionals. Therefore, China should actively implement the national strategies of "revitalizing the nation through science and education" and "strengthening the country with talent" to build a strong pool of innovative talent and enterprises for the low-altitude economy. The government should establish dedicated funds or programs for the low-altitude sector to support tech-focused small and medium-sized enterprises (SMEs). By providing financial support, tax breaks, and fast-tracked approval processes, these policies may encourage startups to tackle key technologies and foster a new generation of industry leaders with strong homegrown innovation capabilities. Universities should be also encouraged to establish relevant disciplines in low-altitude economy management, aircraft manufacturing, intelligent control, and data processing. They should create integrated training bases and joint programs with industry partners to cultivate well-rounded professionals who understand technology, operations, and regulations. Since low-altitude flight routes and applications often cross regional boundaries, regions should strengthen the collaborative flow of talent and projects. By leveraging key industrial parks and free trade zones, they can build low-altitude innovation ecosystems and regional alliances that promote the efficient convergence of talent, capital, and technology. Finally, attracting top overseas talent to participate in low-altitude technology and standards development may help to create an open and inclusive innovation environment, providing a continuous source of internal momentum for the low-altitude economy.

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5.2.3 Streamlining low-altitude regulation

The healthy development of the low-altitude economy depends on a safe, standardized, and efficient governance environment. Currently, China's low-altitude airspace management is fragmented across multiple authorities, including military and civil aviation. This fragmented structure, with its complex and time-consuming approval processes, has become a significant bottleneck that hinders the implementation of technological advancements and the expansion of the industry. To address this, we recommend that the State Council lead the formation of a cross-departmental regulatory body. This new agency may be able to unify the management of both military and civilian airspace resources, establishing a clear, responsive, and efficient service and oversight system. At the central level, it could manage core functions such as airspace designation, flight approvals, real-time monitoring, and data security. Corresponding low-altitude regulatory agencies would be established at the provincial level to coordinate with the newly formed Low-Altitude Economy Development Department under the National Development and Reform Commission (NDRC), thus breaking the fragmented oversight structure. A unified regulatory framework could set clear standards and streamline processes, providing the institutional foundation for the integrated development of technological and industrial innovation. This body should also act as a bridge, promoting information sharing and joint standard-setting among the government, businesses, and research institutions that could foster a two-way innovation mechanism for flight testing and operational demonstrations, potentially creating a supportive policy and market ecosystem for the "high-quality" development of the low-altitude economy.

5.2.4 Forging global partnerships for market growth

With its technology-intensive, application-rich, and industry-driving traits, the low-altitude economy is a key strategic frontier that countries around the world have been vying to dominate. Currently, the United States and European countries have more mature general aviation industries and have established robust technical standards and regulatory systems for airworthiness certification, airspace management, and aircraft manufacturing. China, although holding advantages in aircraft production, new energy, and communications, still faces choke points in critical technologies such as chips and engines. To secure a leading position in this new round of global competition, China needs to participate in and influence the formulation of global industry rules. Domestic research institutions and leading enterprises should be encouraged to conduct joint R&D and collaborative research with top international institutions and high-tech companies. Establishing platforms such as an "International Joint Laboratory for the Low-Altitude Economy" or a "Global Low-Altitude Technology Innovation Fund" could help tackle core challenges in next-generation aircraft and system architecture. China should also leverage national strategies such as the "Belt and Road Initiative" to create multilateral technological cooperation mechanisms. By launching major collaborative projects with BRICS nations, the European Union, and other partners, China may be able to co-develop low-altitude economy technical standards, achieve mutual recognition of these standards, and enhance its rule-making influence in the sector.

6. Conclusion and Outlook

The low-altitude economy, which blends multiple frontier technologies, stands out as a prime example of "new quality productive forces" and a key driver for China's future high-quality economic growth. China's low-altitude sector has moved beyond "conceptual exploration" into "industry building" and has ridden a

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wave of policy support, tech breakthroughs, and capital investment that hint at a leapfrog surge. This paper examined China's low-altitude economy through five lenses: Its development journey, current traits, growth drivers, potential strengths, and real-world challenges. Using industrial ecosystem theory as a guide, it outlined a development roadmap and policy suggestions focused on tightly weaving together technological and industrial innovation. As a critical frontier for nurturing new quality productive forces, the low-altitude economy offers unmatched strategic opportunities alongside complex practical challenges. Only by pushing forward with both tech and industrial innovation can China forge a dynamic, interconnected ecosystem that links players, resources, and conditions to turn the low-altitude economy into a strategic pillar for China's path to modernization and global competitiveness.

Looking ahead, China's low-altitude economy should anchor itself in domestic demand while also keeping an eye on global competition. A few key trends stand out. (1) The rise of a vast commercial ecosystem: The future low-altitude economy will not just be about selling individual products like drones or eVTOLs. It is likely to evolve into a full-fledged industrial ecosystem that covers aircraft manufacturing, smart air traffic systems, tailored application services, and the creation of legal and technical standards. It is also set to team up with emerging tech such as AI, big data, and the Internet of Things to play a role in shaping smart cities. (2) A new strategic frontier in global competition: Europe and the United States currently lead in traditional general aviation, aircraft engines, and chips, and China shines in new-energy propulsion and communication-navigation systems. With global rules yet to fully take shape, the low-altitude economy brings both risks and opportunities. If China can set international standards, crack core technologies, and dominate industrial chains, it could forge new paths to leadership. By tapping into initiatives such as the Belt and Road, China could widen its global market and boost its industrial clout. (3) Profound impacts on daily life and governance: As uses such as low-altitude travel, aerial logistics, emergency response, environmental monitoring, and cultural-tourism experiences grow and become mainstream, the sector could shift from "niche trials" to "everyday applications", weaving into how people work, live, and move. It can become a game-changer for handling crises, modernizing urban governance, and supporting green, low-carbon shifts by offering fresh tools to enhance national governance systems and capabilities. CE

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